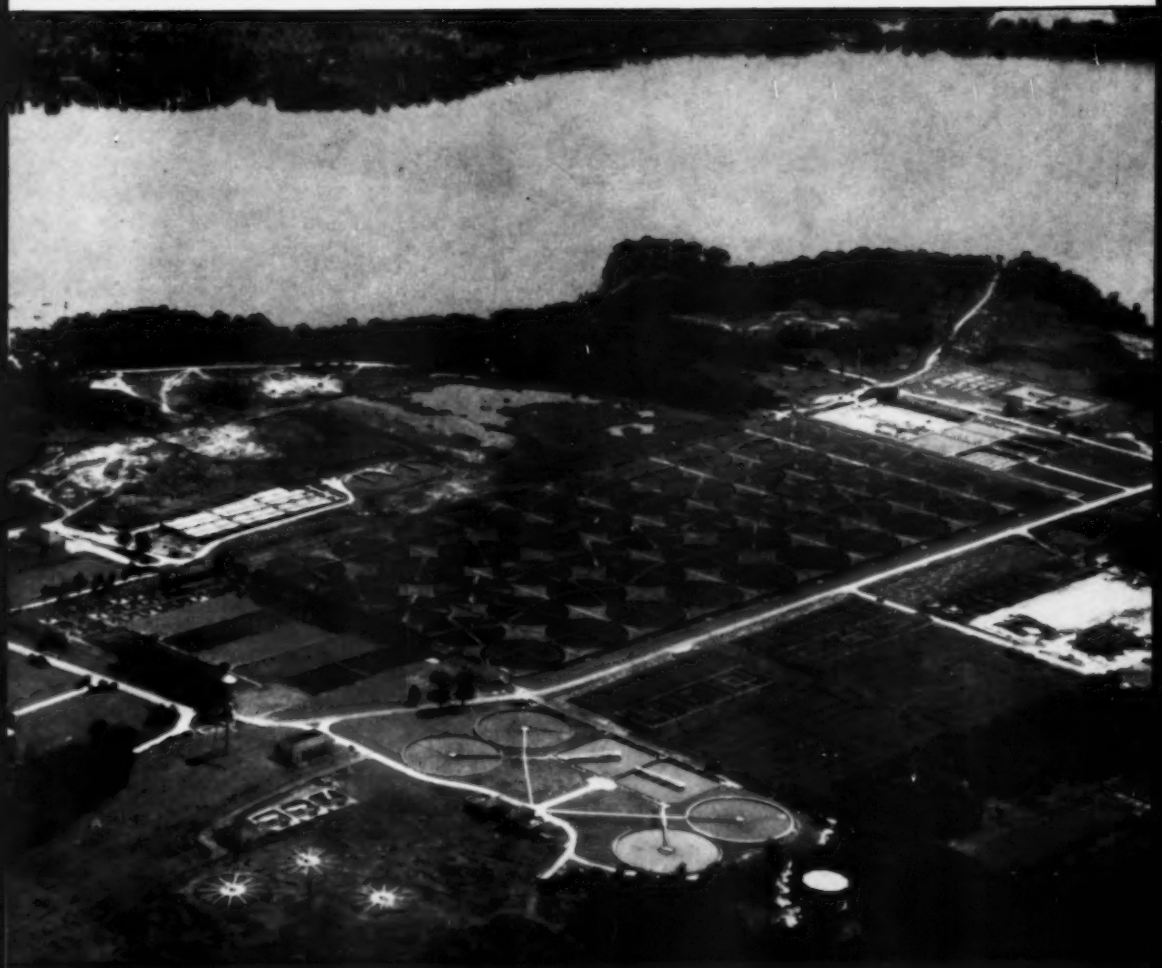
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

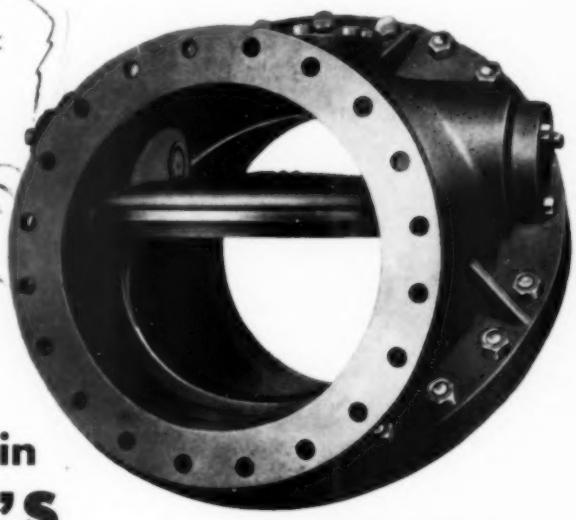


JULY, 1952

Baltimore's Revitalized Treatment Works . . .

40 year old trickling filters rejuvenated.

Here's the One "TILT" that Pays Off On the Level!...

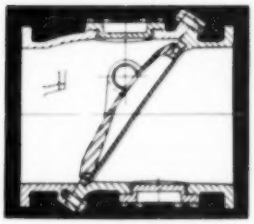


the TILTING DISC in CHAPMAN'S CHECK VALVE

Yes, this is on the level . . . Chapman's Tilting Disc design offers you savings in head loss 65% to 85% over regular swing-type check valves.

For this Tilting Disc rides the flow . . . cushions itself to a quick, *quiet* closure right at the instant when there's no velocity in the line. There's no slamming, under usual pipeline arrangements. So there's no jarring of the line, no opening of the joints, no wear of moving parts worth mentioning. And seating is *drop-tight*.

Certified engineering test-results are charted in Catalog No. 30. Take a look at these tests . . . and then figure what Chapman Tilting Disc Check Valves can save for *you*. Send for your copy now.



Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

THE CHAPMAN VALVE MFG. CO., INDIAN ORCHARD, MASSACHUSETTS

"Dressing The Diver," lithographed on stone for U.S. Pipe and Foundry Co. by John A. Noble, A.N.A.

OUR FLEXIBLE JOINT PIPE is highly regarded by water, gas and sanitation engineers for dependable service in submarine lines. For many years, it has been used in notable and difficult installations throughout the nation.

U. S. flexible joint pipe in all sizes, and pipe 30-inch and larger with other types of joints, are made by the pit cast process. Our pipe, 2-inch through 24-inch, is cast centrifugally in metal molds with bell-and-spigot, mechanical joint or plain ends. All of these types of pipe and joints are widely used for water, gas, sewerage and industrial service and are readily available to meet your requirements.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
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U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

Cutting Valve Costs for a lifetime

This interesting assembly consists of a 20 inch Rensselaer valve with reducing and increasing sections for installation in a 30 inch pipe line. The integral type gear case is designed for the working pressure of the valve and is packed with oil for lifetime service.

There is no need for a concrete vault for valves equipped with integral type gear cases. Just install valve boxes, shovel back the dirt and forget it, for this is the Rensselaer double disc valve with the well known wedge action. On closing, when the gates reach a position opposite their seats, the powerful wedging action presses them squarely and firmly against their seats. It is impossible to damage the stem threads or throw the stem out of alignment, and the gates open and close easily.

The valve you buy today should serve faithfully for many years. Why not provide maximum insurance against future maintenance costs by putting in Rensselaer valves in the first place?

101

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GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES • CHECK VALVES • AIR RELEASE VALVES

A DIVISION OF NEPTUNE METER COMPANY

Sales representatives in principal cities

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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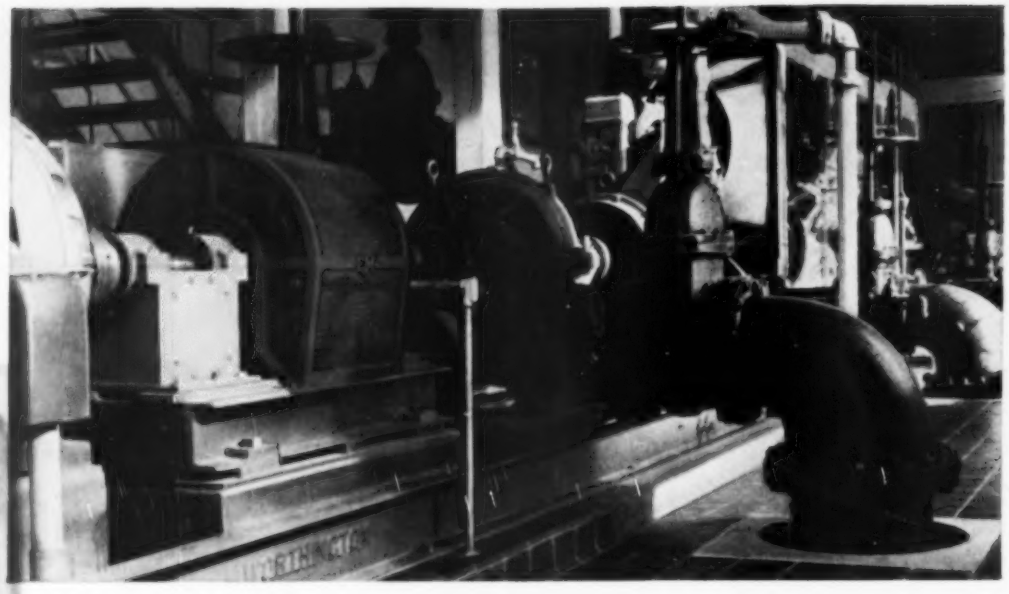


How to Regulate Water Pump Output

E-M Magnetic Drive Offers Automatic, Adjustable Speed Control

● A quick, precise method of varying centrifugal pump output by speed control can save important dollars in water works or sewage plant operation.

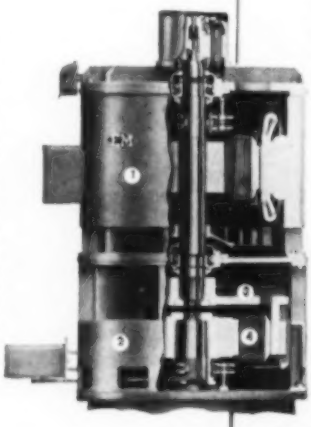
You can get this accurate control most economically with an E-M adjustable-speed Magnetic Drive. In the picture above, a 60 hp, 360 to 1200 rpm E-M Magnetic Drive is furnishing precisely controlled adjustable speed for a centrifugal booster pump.

Operating on the slip-coupling principle, the Magnetic Drive transmits torque *electromagnetically* between the a.c. drive motor and the pump, so that speed itself is controlled directly regardless of other load conditions. The new E-M Regutron Magnetic Amplifier Control for Magnetic Drives provides the most precise adjustment of speed available.

Magnetic Drives may be used to control pump speed by manual setting, or automatically by liquid level, pressure, or volume control. Slip losses in the Drive are well within economical limits so that your power is utilized with little waste.

Ask your nearest E-M sales engineer to point out what E-M Magnetic Drives and Regutron Controls can accomplish in your plant. And write the factory for the publications listed below.

E-M Vertical Synchronous Motor (1) and Magnetic Drive (2) Unit for vertical adjustable-speed power transmission to centrifugal pump. The ring element (3) mounted directly on the motor shaft turns with the speed of the motor. The magnet element (4), mounted inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying the amount of excitation to magnet, pump speed can be precisely controlled.



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☐ Send me Publication No. 1107 on E-M Magnetic Drives and Regutron Controls.

☐ Send me *E-M Synchronizer* No. 33, a special issue on Pumps and Pump Drives.

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Dependable Drives

FOR WATER WORKS AND SEWAGE PLANTS

A BIG NAME

In Sanitation Circles . . .

"HYDROLESE"

HUB

All collectors in service at the Hyperion Sewage Treatment Works, City of Los Angeles, are "HYDROLESE" protected.

Positive protection against overloads—elimination of troublesome shear pins . . certain when Jeffrey "HYDROLESE" Hubs are used on the countershafts with sprockets keyed to them.

The "HYDROLESE" Hub

- Can be adjusted to meet various load conditions.
- Can be provided with visual warning of overload.
- Can be readily reset.
- Will not burn up.
- Will carry a definite torque load (Max. 20,000 lbs.).

This device has won wide favor in Sanitation circles—132 units used on the Los Angeles job. Send for complete information.

Grit Washers	Sludge Collectors	FLOCTROLS
Grit Collectors	Sludge Elevators	Grinders
Cross Collectors	Scum Removers	Chains
Spiral Conveyors	Bucket Elevators	Bearings

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NUCHAR

FIELD TEST REPORT

New Plant Facilities Call For New Threshold Odor Survey

New facilities in a mid-western water purification plant provide for the application of Aqua Nuchar Activated Carbon at one of the following points:

(a) Hydraulic jump, along with the line for pH adjustment and activated silica.

(b) The flocculation basin effluent.

(c) The quick mix.

A threshold odor survey showed raw water entering the plant having a threshold odor value of 18 with an earthy-musty odor. Coagulation and subsequent settling reduced this odor concentration to 10 (a 44% reduction). The odor value remained at this level in the finished water.

Taste tests indicated that the palatable level of the water was equivalent to a threshold odor value of 6 on a finished water having a basic musty potato bin odor. In laboratory tests, Aqua Nuchar effectively reduced the tastes and odors to a palatable level.

A comparison of the various Aqua Nuchar grades also indicated that Aqua Nuchar A would seem to be the best grade for this plant to use both from a viewpoint of economy and odor removal. Laboratory tests conducted on the water from the hydraulic jump, after lime and activated silica application, with a threshold value of 18, demonstrated that Aqua Nuchar A gave a 72% odor reduction.

Laboratory tests and consideration of other plant treatment factors indicated that the use of Aqua Nuchar in the flocculation basin effluent would be the best point of application. At this point, the floc had already formed, and as a result, little of the Aqua Nuchar would be enmeshed in the floc, allowing greater efficiency for taste and odor absorption. This point was also far enough ahead of the breakpoint application in the quick mix so that maximum efficiency would be obtained by the Aqua Nuchar as well as the chlorine.

Why not arrange with our nearest office to have an Aqua Nuchar Technical Service Expert conduct, without obligation, a threshold odor survey in your water works plant?

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Expensive Shutdowns

. . . and reduced capacity with costly man-hours for repairs may be incurred unnecessarily.

Your Efficiency

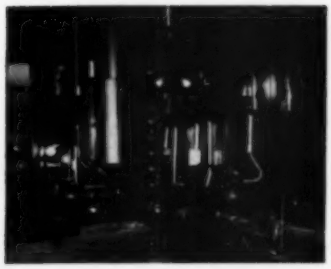
Ruined equipment, the loss of capacity, and repair expenses caused by shutdown mean only one thing . . . increases in operating costs.

RIGHT NOW . . . you should investigate the economies of using Amercoat; a *line* of coatings built to protect against *specific* industrial corrosion hazards.

Our field engineers are available . . . without obligation . . . to check your plant for corrosion problems . . . and to give you *specific* recommendations.

AMERCOAT CORPORATION

In Lansing, Michigan's sewage disposal plant additions . . .



Byers Wrought Iron gas lines leading to pressure regulators for the heating units

Byers Wrought Iron pipe installed in influent aeration tunnel

Byers Wrought Iron Pipe

helps check maintenance and repair

When Lansing, Michigan, constructed its new sewage disposal plant additions, the sound policy of building for permanence was followed. To forestall excessive maintenance and repair, the engineers used a time-tried material —Byers Wrought Iron pipe—for steam heating lines, hot water circulating lines, gas lines, and exhaust lines for engines. Engineers for the project were Drury, McNamee & Porter; piping contractor was J. M. Foster Company.

This adds another to the impressive list of plants—old and new, large and small—where Byers Wrought Iron pipe is helping to maintain smooth production schedules, and to reduce maintenance headaches and costly repairs or replacement. In the sewage treatment plant at Salina, Kansas, for instance, this material was used to safeguard 7 vital services. And at Hyperion sewage treatment plant, Los Angeles, Byers Wrought Iron pipe was put to work in 51 services where corrosion was a threat to durability. These are only two of many installations throughout the country that indicate the confidence engineers place in the material.

Our bulletin, WROUGHT IRON FOR SEWAGE TREATMENT AND DISPOSAL INSTALLATIONS, will give you some helpful information on how to keep maintenance costs down. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

Why Genuine Wrought Iron Lasts

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

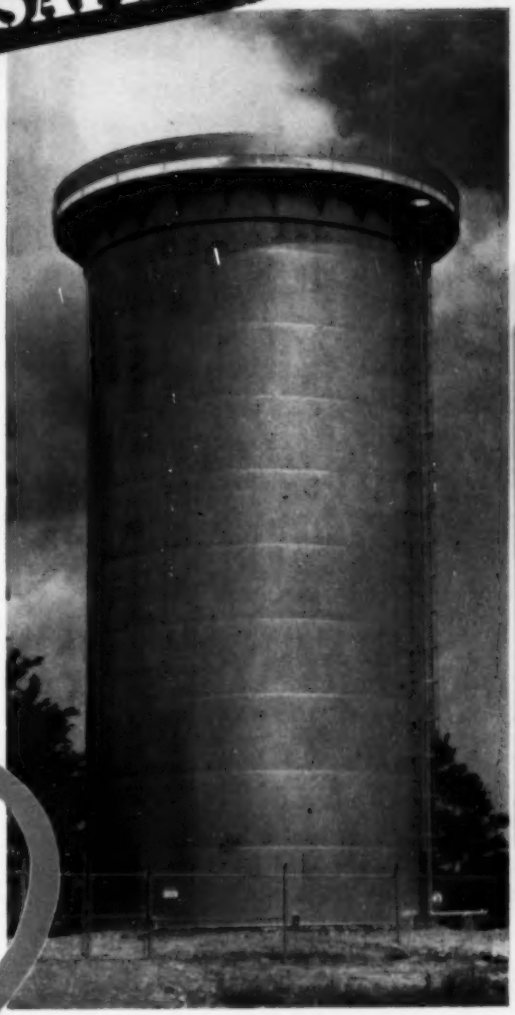
MARGIN OF SAFETY

AGAINST MUNICIPAL WATER SHORTAGES

In Brewer, Maine—across the Penobscot River from Bangor—there's a 750,000-gal. Horton standpipe built by the Chicago Bridge & Iron Company for the Brewer Water District. This large welded steel structure increases the storage capacity in the water distribution system to 1,350,000 gallons and, most important, it provides a margin of safety against temporary water shortages. Now, both adequate fire flow and peak consumer demands can be met in Brewer.

Horton standpipes are built of *welded steel* construction for lasting, dependable service. Painting and maintenance are easier and more economical. Standard capacities range up to 10,000,000 gallons.

For more information, write our nearest office. There is no obligation on your part.



An Exclusive Horton Feature

The steel used in the construction of this standpipe for Brewer, Maine was pickled and painted before it was shipped from our Greenville, Pa., plant. This efficient process removes mill scale from the metal and leaves a coating of iron phosphate on the surface, forming an excellent bond for the prime coat of paint.

750,000-gal. Horton standpipe, 40-ft. in diam. by 81-ft. 7-in. in height built for the Brewer Water District, Brewer, Maine.

HORTON

WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

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Boston 10	1048—201 Devonshire Street	Philadelphia 3	1644—1700 Walnut Street Building
Chicago 4	2198 McCormick Building	San Francisco 4	1583—200 Bush Street
Cleveland 15	2262 Guildhall Building	Seattle 1	1350 Henry Building
Detroit 26	1551 Lafayette Building	Tulsa 3	1646 Hunt Building
Houston 2	2115 C & I Life Building	Washington 6, D.C.	1109 Cafritz Building

Two No. 1000 Gas and Oil Fired Units with "DME" Controls at Lansing, Mich. Drury, McNamee & Porter, Consulting Engineers, Ann Arbor, Mich.

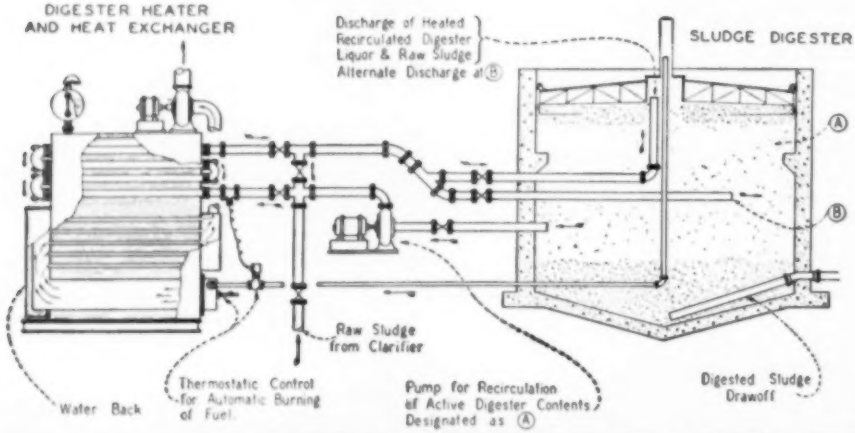
with

THE P.F.T. DIGESTER HEATER & HEAT EXCHANGER

Eliminates hot water heating coils in the digestion tank with the maintenance problems, which have necessitated periodic interruption of operation to remove the insulating sludge which bakes on the coils—or to repair or replace the coils themselves.

The P.F.T. digester heaters are conservatively designed for maximum periods of maintenance-free operation. However, all parts are readily accessible and easily serviced without interrupting digester operation. Digester heating is accomplished by circulating the digester contents through the external heat exchanger tubes. Raw sludge is pre-heated and mixed with circulating digester liquor before adding to the digester, insuring proper seeding of the raw solids and close control of the digester temperature. Heaters are arranged for firing with sludge gas, with or without auxiliary fuel, which may be either oil, natural gas or manufactured gas, and also are arranged to utilize waste heat from power producing sludge gas engines.

In addition to supplying all of the heat for digestion, P.F.T. heaters provide a source of automatic heat for plant buildings.


DIGESTER HEATER AND HEAT EXCHANGER
Discharge of Heated Recirculated Digester Liquor & Raw Sludge Alternate Discharge at (B)
SLUDGE DIGESTER
(A)
(B)
Raw Sludge from Clarifier
Water Back
Thermostatic Control for Automatic Burning of Fuel
Pump for Recirculation of Active Digester Contents Designated as (A)
Digested Sludge Drawoff

P.F.T.

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Denton, Texas. 2,000,000-gallon Standpipe; diameter 70'0", height 70'6".

Ottumwa, Iowa. 4,200,000-gallon Reservoir; diameter 110'0", head range 60'4".

Woodstock, New York. 100,000-gallon Standpipe; diameter 26'0", height 25'6".

On high-ground locations, Pittsburgh-Des Moines Steel Standpipes and Reservoirs offer maximum values in low-cost water storage, providing water at gravity pressure to the distribution system, and delivering many years of useful life with minimum maintenance. • Guaranteed in design, workmanship and materials, these structures are permanently watertight, unaffected by climatic changes, and may be erected at any time of year. Capacities range from 50,000 to 5,000,000 gallons. Write for descriptive bulletin.

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CHICAGO (3) . 1222 First National Bank Bldg.	SEATTLE . . . . . 526 Lane Street
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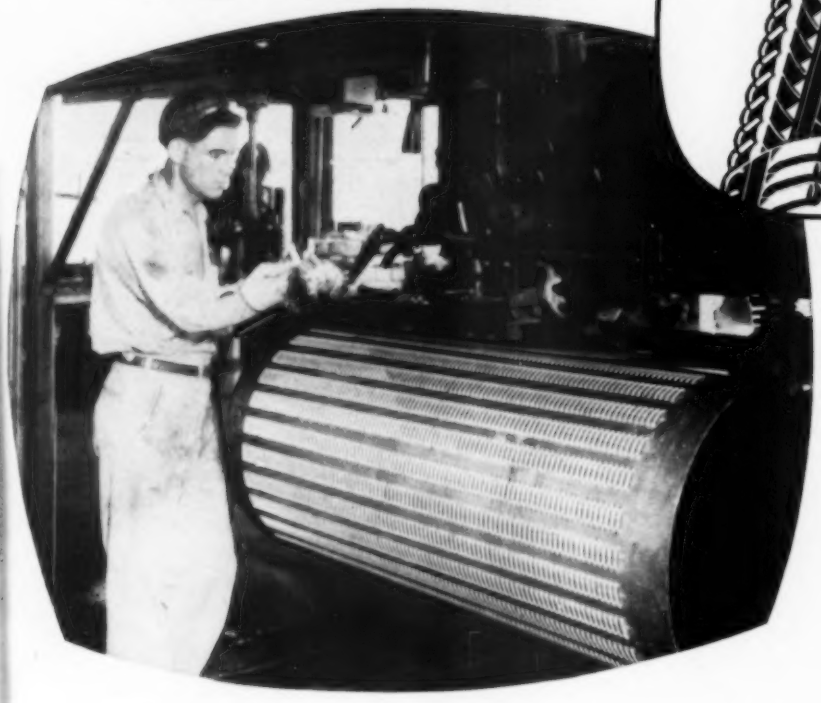
Screen Making
looks mighty simple



• • The outstanding features of Layne constructed wells and pumps are pictured and described in a catalog entitled "Layne Well Water Systems." A copy will be sent on request.

Screen Making—is simply a matter of making the right kind of openings of the right shape in the right arrangement in the right metal to fit into the well in the right manner so that the right amount of water can enter the pump bowl area with a minimum amount of resistance while holding back the sand formation. Outside of those details the job is quite simple.

And the right kind of screen in a well is about as important as is the right kind of motor in an airplane. Fifty years ago, Layne bucked the screen problem and came up with something that hasn't been matched by any other manufacturer.

If Layne builds your water supply units and if sand screen is necessary, your job will have the famous Layne horizontally slotted screen. This means that your well will have a longer life, produce more water and operate on a lower cost than is possible with ordinary conventional screens.

For further information about water wells and complete water supply installations with Layne sand screens, address

LAYNE & BOWLER, INC.
General Offices, Memphis 8, Tenn.

Layne
WATER WELLS
VERTICAL TURBINE PUMPS
WATER TREATMENT

CORAOPOLIS, PA.

Coraopolis Borough Water Works

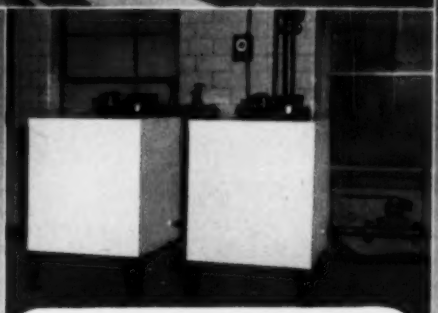
(ADDITIONS COMPLETED IN 1949)

THE CHESTER ENGINEERS
Consulting Engineers
PITTSBURGH, PA.

H. B. HARRIGER
Supt. of Water Plant
CORAOPOLIS, PA.

The city of Coraopolis (population 11,500) is located in hilly country on the East bank of the Ohio River, about 11 miles from Pittsburgh. In recent years, growth of both population and heavy industry necessitated a large increase in the city's water supply. To answer this need, the Coraopolis Borough Water Works has been enlarged and now has a maximum rated capacity of 3 MGD, double its previous size.

Because the raw water is drawn from deep wells, the Water Works must deal with a water hardness problem and, for this purpose, Omega Precision Solution Feeders were installed by the contractors, Pitt Construction Co., of Pittsburgh. These Feeders deliver brine and caustic soda solutions and are arranged for automatic proportional control by Builders Flow Metering Equipment. For complete information on Omega Feeders, address Omega Machine Co. (Division of Builders Iron Foundry) Providence 1, Rhode Island.



B-I-F Industries Equipment furnished for the Coraopolis Borough Water Works:

OMEGA:
Precision Solution Feeders arranged for proportional control.

BUILDERS-PROVIDENCE:
8" Model RCE Controllers with Loss of Head and Rate of Flow Gauges.
6" Orifice Plate with Flo-Watch Totalizer-Indicator-Recorder and batch control mechanism.
12" Orifice Plates with Chronoflo Totalizer-Indicator-Recorders.
2" Propeloflo Meter.

B-I-F INDUSTRIES

OMEGA
THE LAST WORD IN FEEDERS

Ω OMEGA

By any Yardstick...

FAIRBANKS-MORSE
MEASURES UP TO YOUR NEEDS

How do you measure large centrifugal pumps for your water works needs?

By Dependability?
Fairbanks-Morse scores top ratings here. Rugged design and construction . . . careful testing . . . years of successful application make Fairbanks-Morse Centrifugal Pumps a preferred choice for dependability.

By Ease of Servicing and Maintenance?
Fairbanks-Morse Pumps are noted for their minimum maintenance requirements. And, when servicing is needed, Fairbanks-Morse accessibility makes it fast and easy. For example, the entire rotating impeller element can be removed without disturbing driver, suction or discharge piping.

By Performance?
Here, again, Fairbanks-Morse Pumps lead the field. They develop the highest possible efficiency over a wide range of performance. It's common practice for a Fairbanks-Morse Pump to exceed its efficiency guarantees.

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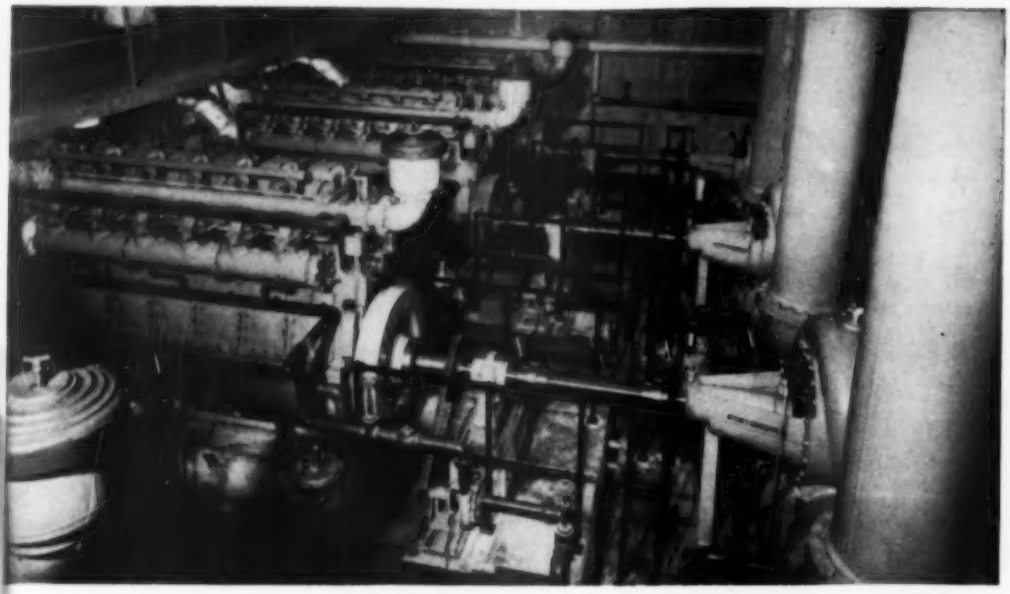

FOUR 20-MGD CENTRIFUGAL PUMPS (right) pump raw sewage into Oklahoma City's Southside Sewage Treatment Plant. Worthington Sewage Gas Engines (left) drive pumps. Installation uses three other such pumps for recirculation, also driven by Worthington engines.

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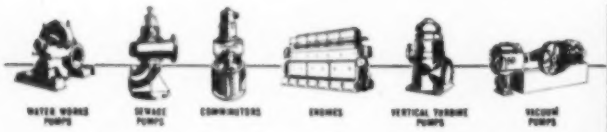
W.3.2



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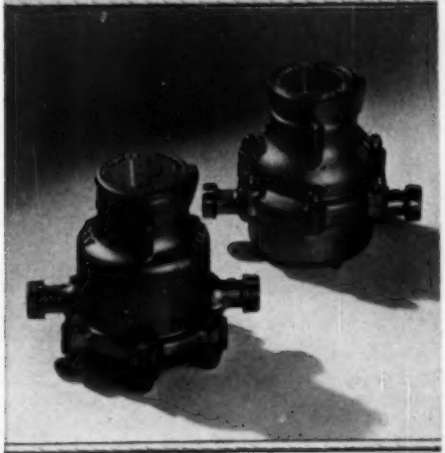

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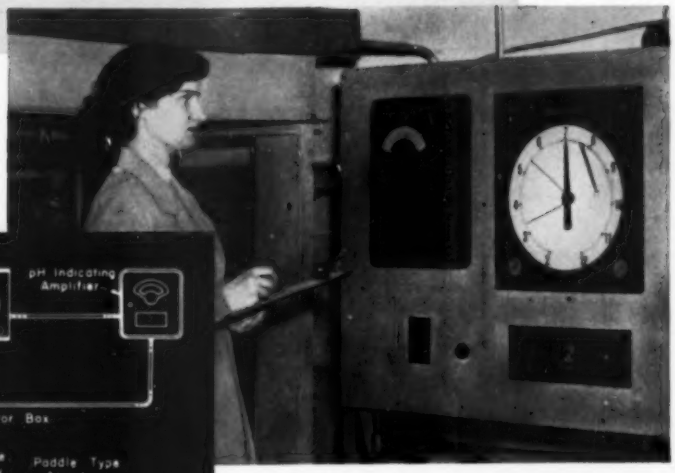

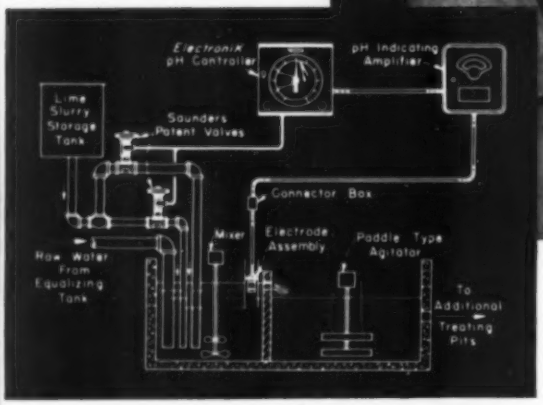

View of panel-mounted pH recorder-controller and indicating amplifier. Schematic diagram of pH control system, at left.

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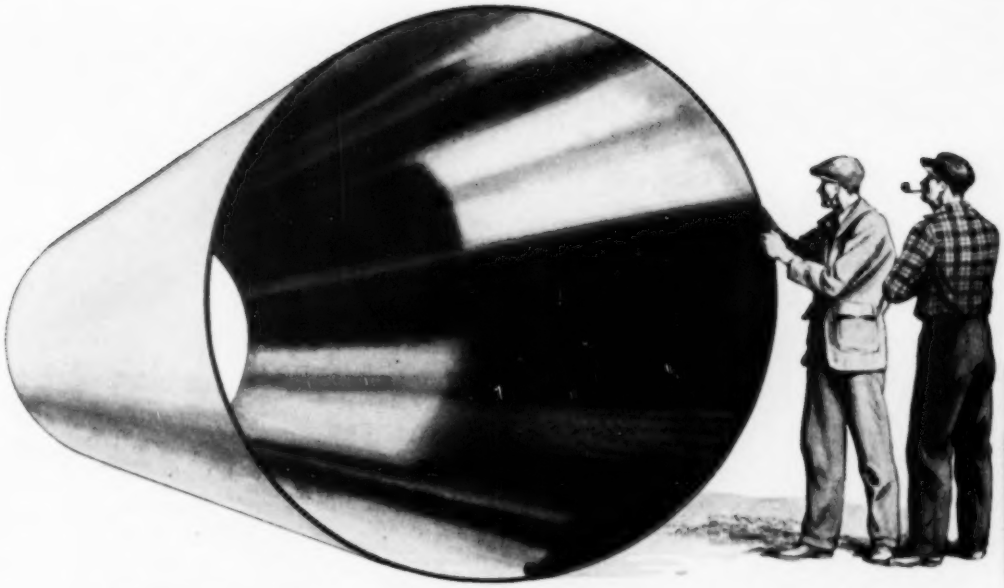

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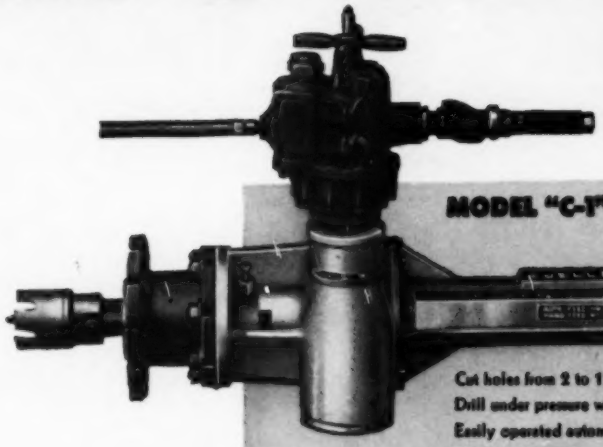

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For use on pressures to 300 lbs. P.S.I. and temperatures to 250°.
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Telescoping vital working parts for compactness.
Backed by almost a century of engineering experience.

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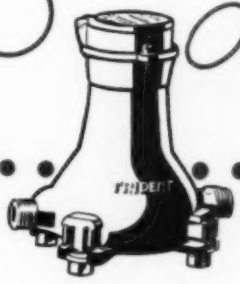

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WATER & SEWAGE WORKS

VOL. 99, NO. 7 • A GILLETTE PUBLICATION • JULY 1952

1952 Annual Roundup of A.W.W.A.

Technical Sessions at Kansas City*

IN this issue we present the first installment of reports on technical sessions included in the program of the 72nd Annual Conference of the A.W.W.A. There were sixteen individual sessions — various division meetings, general sessions, and open meetings of association committees. This installment summarizes the papers presented in General Sessions and in the Water Works Management Division. Reports on other sessions will be given in a later installment.

An entire session of the Water Works Management Division was devoted to consideration of various aspects of water fluoridation. The capacity audience, which remained through a long afternoon, provided the best evidence of the wide interest in this subject.

Fluoridation Expands

A CENSUS OF FLUORIDATION—NATURAL AND APPLIED was reported by O. J. Muegge, State San. Engr., State Board of Health, Madison, Wis., Chairman, and his Task Group on Fluoridation Materials and Methods. J. C. Zufelt, member of the Group, presented the report in the absence of Mr. Muegge.

The data collected show fluoridation treatment is being applied in one or more plants in each of 38 states of the U.S. and in one province of Canada. Up to March 31st of this year 208 municipalities were applying fluoride treatment to water delivered to 278 communities, thus serving a population of 4.8 million.

A survey of data on the natural fluoride content of water supplies (44 states) indicates a population of 3.0 million receives water containing 0.7 to 1.49 ppm. fluoride ion. Thus, over 7.8 million consumers are obtaining what is generally considered the optimum concentration of this trace element.

"Grand Marshall"

Tom Veatch, Chmn., Convention Management Committee —which deserves high credit for a bang-up job.

Over one-half of the population served by fluoridation plants is included in the states of Michigan (21 plants), Wisconsin (74 plants), Indiana (6 plants), and Kentucky (6 plants).

The population served by these plants is: Michigan, 756,216; Wisconsin, 692,853; Indiana, 610,394; and Kentucky, 405,000.

Pending installations reported for 1952 are likely to exceed those in 1953; i.e., the number of plants adopting the treatment may represent a decelerating program. But a number of larger cities are planning on installing fluoridation treatment, and a substantial increase in population served is contemplated. The most ambitious program is that of Puerto Rico, wherein the Dept. of Health contemplates complete coverage *within a six-year period* of all communal water supplies (serving a population of 927,000).

A review was included of fluoridation chemicals and fluoridation equipment. Extensive consideration was given to plant personnel protection, the equipment and practices recommended to meet this need. Fluoridation plant controls were surveyed, and the requirements of various states were summarized. Publication of the complete Task Group Report will provide useful and up-to-date information on fluoridation practices.

Fluoridation Problems

EXPERIENCES WITH FLUORIDATION—A SUPERINTENDENTS' PANEL included W. Victor Weir, Pres., St. Louis County Water Co., St. Louis, Mo., as moderator. Members of the panel were:

Walter M. Franklin, Supt., Water Dept., Charlotte, N.C.

Acres of Technical Exhibits

New Water Works Products—and the new Water & Sewage Works Booth

Water & Sewage Works in the June issue reported meeting highlights, new officers, and award and prize winners.

Fluoridation Programmers

G. J. Maeyaert, State San. Engr., Madison, Wis. — *W. Victor Weir, St. Louis Cty. Water Co., St. Louis, Mo.* — *J. H. Murdoch, Amer. Water Wks. Service Co., Philadelphia, Pa.* — *J. C. Zufelt, Supt. of Water, Sheboygan, Wis.*

James E. Kerslake, Supt. of Filtration, Milwaukee, Wisc.

John E. Kleinhenz, Publicity Director, Indianapolis Water Co., Indianapolis, Ind.

H. C. Medbery, Engr. of Water Purif., San Francisco, Calif.

Guy Morrow, Mgr., Peoria Water Works Co., Peoria, Ill.

John H. Murdoch, Vice-Pres., Amer. Water Works Service Co., Philadelphia, Pa.

Jerome C. Zufelt, Supt., Board of Water Comrs., Sheyboygan, Wis.

MR. WEIR reviewed briefly the practice of water fluoridation for reducing the incidence of dental caries. Where the natural content of fluoride ion in water is low, communities should give careful consideration to this supplemental treatment—but action by water works authorities should await that of local and state health bodies, and fluoridation approval should depend upon public demand. He introduced panel members as men having practical experience in water works operation.

MR. MEDBERY outlined developments in California, where the practice of fluoridation has aroused considerable controversy. State medical and dental societies, chambers of commerce, and other groups have participated actively in advancing the program—while certain church groups, chiropractic associations and others have opposed it with equal vigor. He recited the pro and con material utilized in the respective campaigns. Apparently, the most important effect has been to establish doubts in the minds of people generally as to the desirability of the practice.

MR. MORROW described the attitude of management toward fluoridation. In Peoria, promotional work has been extensive and those against the treatment have worked equally hard. The populace seems about equally divided. The local dental society has recommended the practice, but the health committee has returned its resolution as being based on insufficient evidence. The Peoria Water Works Co., having determined cost data, responsibilities, and approval required, neither opposes nor approves adoption of the treatment.

MR. FRANKLIN discussed matters of legal protection for water works management. The city of Charlotte, N.C., had pioneering problems to solve; authorities agreed that responsibilities of the water department be restricted to the mechanics of fluoride application, while the health department assume responsibilities and pay the cost. This method has worked out satisfactorily.

MR. ZUFELT reviewed cost considerations in the treatment of water with fluorides. He noted that, while a good case can be made for the local health department carrying the charges for fluoridation, generally the water utility must either absorb the cost of treatment or raise rates to cover the cost. In 1949, the Wisconsin legislature made it mandatory for the costs of fluoridation to be included in rate increases (for public or private water utilities using this treatment). Should the costs be charged to the first, or minimum rate bracket? This procedure, in Sheboygan, increases the minimum rate of $1.35 by 13 cents.

Legal Considerations

MR. MURDOCH presented very helpful legal comment regarding the practice of fluoridation. If the community demands fluoridation, a utility can provide the treatment while neither favoring nor opposing—but operating costs must be reimbursed. He interpreted as the consensus of opinion:

That changes or new interpretations of statues may be required in certain states which now consider water as a food and bar the addition of "poisons" to food.

That action may be required regarding acts prohibiting the presence of fluorides in non-alcoholic beverages.

That new problems may arise in the processes involving evaporation as these may increase the fluoride content of foods, medicines, etc.

That liabilities for damages, arising from fluoridation, involve several considerations which he interpreted as:

(a) *Mottled teeth* would not be a liability of the water utility, because the evidence now points to some slight increase in mottling when water is fluoridated. The principle of law involved is that risk of harm to a minority is far offset by benefits to a majority (a condition of "reasonable risk").

(b) *Mottled teeth in epidemic form* would not be a liability as the water purveyor is not held to guarantee the quality of water and negligence must be proved. (Personally, he holds that the water purveyor does imply the purity of water, and that negligence need not be proved.)

(c) *Future damages* or unfamiliar diseases which, in years to come, may be caused by fluoridation, will not be the responsibility of the water purveyor. Under the law of negligence, the utility is liable for present actions only in accordance with factual knowledge of the time, and not for facts later established.

Mr. Murdoch holds there is no comparison between responsibility for water containing typhoid organisms and that containing fluoride ion in a concentration approved by health authorities.

MR. KERSLAKE described the problems involved in equipment installa-

Fluoridation Programmers

W. M. Franklin, Supt. Water Dept., Charlotte, N.C. — *J. E. Kerslake, Supt. of Filtration, Milwaukee, Wis.* — *H. C. Medbery, Engr., Water Purif., San Francisco, Calif.* — *Guy Morrow, Mgr., W.W. Co., Peoria, Ill.*

tion (total cost to Milwaukee, $11,000), safe handling by personnel, and resultant labor union demands (new duties for operators may mean higher salaries).

MR. KLEINHENZ presented a very long and detailed review of fluoridation practice in Indianapolis, emphasizing the successful development of favorable public reaction.

OPEN DISCUSSION was limited, unfortunately, by the late hour reached when the all programmed papers had been presented.

DR. A. P. BLACK (Univ. of Florida) called attention to the fact that, as the number of fluoridation installations increase, the fluoride ion content of streams receiving municipal wastes will become higher. Thus, where

L. N. Thompson
Genl. Mgr.
Water Dept.
St. Paul, Minn.

J. C. Keith
Gen. Mgr., Util. Com.
Windsor, Ont.
Canada

A. P. Kuranz
Manager
Water Utility
Waukesha, Wis.

W. R. LaDue
Ch. Engr. & Supt.
Water & Sewage Bur.
Akron, O.

Rate Adjustment Panel

A. O. Norris
Exec. Vice-Pres.
Indianapolis Water Co.
Indianapolis, Ind.

C. F. Wertz
Resident Engr.
Water & Sewers Dept.
Miami, Fla.

municipal water supplies are derived from such streams, there will be a greater "natural" fluoride concentration.

MR. ZUFELT cited the lack of complaints from industrial users of fluoridated water; none have arisen from breweries, food processors, pharmaceutical manufacturers, or others about which some question existed. "Cracked ice" caused by fluoridated water at Charlotte, N. C., and at Little Rock, Ark., has been readily corrected when manufacturers use anti-crack tablets in the water.

ROGER C. HIGGINS, chemist, Board of Public Works, Hannibal, Mo., chairman of an educational committee of the Missouri Section of the A.W.W.A. stated that popular opposition to fluoridation is growing "as people become better educated concerning the practice." He expressed resistance to the practice of fluoridation as "interference" with the water works industry—opening the door to any future "crackpot ideas." He considered fluoridation to be evidence of socialism and to constitute infringement of individual rights.

CHAS. R. COX, Chief, Water Supply Section, N. Y. State Dept. of Health, replied that the precedent established by a population of some 3 million having long consumed naturally fluoridated water supplies evidence of its desirability. The practice is not socialism, but merely supplemental treatment. He referred to cost allocation, considering that payment by a local health department would introduce complications in many instances—particularly where a municipal supply serves more than one community.

MR. D. B. WILLIAMS, in Charge of Purification, Public Utilities, Brantford, Ont., Canada, expressed dismay over the apparently growing trend that everything should be "put up to a vote." A very difficult situation would exist if immunization, pasteurization, and chlorination were put up to a vote, he pointed out. Evidently, some police powers must be delegated to health officials—and Mr. Williams believes that, in such matters, informed technical opinion should decide what is best for the public.

Rate Adjustments—Selling Them to the Citizens

A panel moderated by Leonard N. Thompson, Supt. of Water at St. Paul, Minn., and past president of the Association voiced experiences in "Selling Rate Increases to the Citizens."

C. F. WERTZ, Resident Engr., Miami Dept. of Water and Sewerage, led off by reviewing newspaper publicity setting forth needs for rate increase of 25% which was later moderated to a more pleasing 14% supported by independent consultants and voted by the City Commissioners. The minimum bill allowance per house meter was decreased to 1800 cu.ft. from 2700 cu.ft. whereas the old minimum charge per month was not boosted. Although there was little objection to the rate boost the water use dropped appreciably.

A. O. NORRIS, V.P. and Genl. Mgr. Indianapolis Water Co., Indiana, said that his company had found that the policy of trying by every means to keep everybody informed and see that all information released be wholly accurate paid better than any other means to sell the public on the needs for a moderate rate increase—the first since 1933. One telling bit of selling the value of good water and efficient service had been realized through newspaper ads and editorial stories comparing the cost of water service with that of other commodities and services. Making contacts with the newspaper editors, the Public Service Commission and city officials and telling the story of planned improvements which were to be financed from increased income from the realistic rate increase proved to be a telling argument. The same stories were given newspaper reporters who developed interesting news stories in combination with rate increase "pitch". The plan to start fluoride treatment for the benefit of the city's children and the parents' pocketbooks comprised one argument for the rate increase developed to pay the costs of fluoride enrichment of the water played its part. Mr. Norris said that a most important consideration in getting public acceptance of rate increases was to have a reputation for keeping the water system up to par with good service. Lacking this, no amount of publicity could correct impressions in the minds of the public.

ARTHUR P. KURANZ, Supt. of Waukesha, Wis., pointed out that municipal water utilities are regulated by the Wis. Utility Comm. just as privately owned utilities are. Both are permitted to earn 5½% on the investment. When such is not attained rate increases are in order, if not actually ordered. The Commission consists of uniform accounting by all water utilities, with definite depreciation patterns established for various water system units. Beyond the 5½% profit, held for water system betterments, municipal water works are permitted to contribute a

Programmers

Manufacturer
Wm. J. Orchard
Gen. Mgr., W & T Co.
Newark, N.J.

Rainmaker
Irving P. Krick
Water Res. Devel. Corp.
Denver, Colo.

1951 Flood
N. T. Veatch, Jr.
Black & Veatch
Kansas City, Mo.

Water Service
R. G. Kincaid
Burns & McDonnell
Kansas City, Mo.

reasonable amount from water profits to the city's general fund—a taxpayer's "dividend" so to speak. Under State Utility Commission regulations there is little need for selling the public on the rate increase based on proven need and Commission approval. Interestingly the cities are required to pay the municipally-owned water utility a fair charge for fire protection service which frequently is accompanied by a rate adjustment downward for customers in low brackets.

MORRIS JONES, Genl. Mgr. & Chief Engr., Pasadena Water Dept., Calif., who had recently put in a 33% rate increase, publicized the increased cost of water purchased from the Colorado Aqueduct as well as the increase in costs of all materials and equipment. There had been no revolt against the new rates.

CLARK KEITH, Genl. Mgr., Utilities Comm. of Windsor, Ontario, makes good use of newspaper space for paid advertising to extent of 0.25% of income. This space had been used to tell the public of the relative costs of water service as compared with other things. The 13% rate increase was to raise the water bill of the average family to the extent of the cost of one package of cigarettes every 2 months. Mr. Keith, questioned on his statement that $250,000 per year was paid the water utility by the city for fire service, made many a water manager envious by explaining that automatically the water utility receives 2 mills on the assessed valuation of property in the city. At present this amounts to 25% of the overall income. He emphasized the value of a friendly and helpful press and personal contact with the editor.

WENDELL LADUE, Supt. and Chief Engr., Bureau of Water and Sewerage, Akron, Ohio, related how the $7,500,000 expansion program was first sold to industry, then to the Engineering and the Finance Committees of the Chamber of Commerce before selling it to other civic groups and labor unions. Only after selling the expansion program was the matter of rate increase brought into the picture. Although municipal utilities in Ohio are not permitted to purchase advertising space the editors of the papers had been most helpful in boosting the improvement program and pointing to the need for rate increase. Mr. LaDue in answer to a question stated that a straight increase in rates is preferred to a percentage increase. He also said that the reputation of the Water Dept. for keeping ahead financially had been a great asset in the selling of the proposed expansion program.

Water Supply Industry Needs a Safety Program

GEO. MACDONALD, Natl. Safety Council, Chicago, presented the picture of the water utility industry which had taken little or no interest in the matter of promoting "Safety in Water Works." He pointed out that only 34 water utilities were members of the Nat'l. Safety Council. Surprising to many, the ratio of accidents to number of employees was higher for water utilities than any other utility group. In the smaller plants the ratio was much higher than in the larger plants. The average cost per accident in the water group had been $369. He suggested a careful check-up on the cause and cost of accidents, then reconsider the benefits to be derived from membership in the Nat'l. Safety Council which has 28 engineers ready to help the water supply industry.

W. R. LA DUE said that he considers a safety program in water works an essential activity, based on 10 years of accident records.

CLARK KEITH said that compensation insurance in the electric field is lower than in the water field in Canada.

Awardees

Diven Medal
Ernest W. Whitlock
Malcolm Pirnie Engrs.
New York, N.Y.

Goodell Prize
Joseph M. Sanchis
Dept. Water & Power
Los Angeles, Calif.

More Water

Three technical papers comprising one General Session all related to the subject of obtaining more water—from weather control projects or from the sea. The potential methods discussed proved to be of wide general interest. Dr. A. E. Berry, Director, San. Engr. Div., Ontario Dept. Health, presided as chairman of this session.

Artificial Rainmaking

RAIN INCREASE PROJECTS IN RELATION TO WATER RESOURCES was the title of a paper presented by Irving P. Krick, Water Resources Development Corp., Denver, Colo.

"True rainmaking is still in the future," said Mr. Krick, who claims artificial rainmaking—to date—can only *increase* the efficiency of nature. About one-half of 1 per cent of overhead moisture is precipitated by nature in a heavy storm; when man can increase the amount artificially to one per cent, he doubles the volume of rainfall. "Helping nature to do a better job" is Mr. Krick's definition of the present status of experimental studies. The eventual problem will be one of storage and distribution.

The mechanism used today (aiding the formation of ice crystals by the use of iodide generators) is not applicable for conditions in the tropics, where suitable clouds are not available. Methods other than super-cooling must be discovered. Large scale of operations is essential; farmers are interested when, working in terms of 10 million acres, costs can be as low as one cent per acre per year.

The implications are international—augmented rainfall, could increase the food supply and hydroelectric power in countries such as Spain, Italy, North Africa, and the Near East. Mr. Krick, just returned from visiting these countries, estimates 20 per cent additional rainfall could make these countries self-sufficient without other aid.

He reviewed the development of rain increase methods, beginning with use of dry ice for cloud seeding. Silver iodide generators, located at many

strategic ground installations, have proven most effective. Silver iodide is dissolved in acetone, dried on coke, and discharged from a forced-draft electric furnace into rising columns of warm air.

Mr. Krick used lantern slides to describe preoperational analyses, cloud seeding, and evaluation of results. He cited statistics regarding accomplishments in one area where the cost of the project was high ($.25 per acre) the return was very good ($2.60 per acre). He considers much more technical data to be necessary for sound development of rain increase projects.

Water from the Sea

SEA WATER AS A SOURCE OF FRESH WATER was the subject discussed by E. D. Howe, Prof. of Engineering, Univ. of California, Berkeley Calif.

Funds for this research study have been appropriated by the legislature of the State of California, and Mr. Howe's progress report on the project was presented as a preliminary review.

A plant is under construction to utilize what, theoretically, appears the most promising of methods: triple-effect distillation in combination with a Diesel engine power plant. It is expected that this method can provide about 5.8 gal. of distilled water per KWH of power.

An experimental plant to investigate a record method is expected to operate in June 1952. This method may be described as a temperature-differential combined power plant and distiller. The cold water will be obtained by means of a deep water pipe line. There will be variations of this nature: cold sea water in at 60°F. and out at 72° F.; warm sea water in at 95°F.; and distilled water out at 80°F.

A solar distillation plant is already under study. (This concept is not new, having been proposed as early as 1883.) A solar still operates as a "mouse trap for sunlight," because of differences in temperature between the water and the glass above it. Probably less than 4 sq.ft of glass will be required to provide one gallon of water per day (a construction cost of about $4 per gal. per day).

The approximate construction costs for these methods, in terms of gal. per day, is estimated to be $.50 for distillation and Diesel power, $1.00 for temperature—differential distillation and power, and $4.00 for solar distillation.

A discussion of Prof. Howe's paper was prepared by Prof. W. F. Langlier, Univ. of Calif., and was read in the absence of the author by G. E. Ferguson, Water Resources Div., U.S. Geological Survey.

It was pointed out that chemists appear more optimistic than do engineers regarding the potential utility of sea water as a source of fresh water. A "free energy difference" between salt and fresh water exists—and might provide as much power as 10 KWH per 1000 gal. of water. Progress has already been made in the development of "concentration cells," through which brine and fresh water streams flow in opposite directions. The efforts of engineers and chemists will certainly continue until the possibilities have been evaluated.

W. W. Aultman, Miami, Vice-Chmn., Purif. Div., asked if the construction cost data cited by Mr. Howe included the charges for elevating water to usable levels, and was assured that pumping stations were a part of each method.

Weather Control Legislation

REVIEW OF LEGISLATIVE PROPOSALS AND ENACTMENTS ON WEATHER CONTROL was the title of a task group Report presented by E. H. Guyer, chairman. Mr. Guyer is Secy.-Supt., Escondido Mutual Water Co., Escondido, Calif.

Man's attempts to control the weather began only recently with the heating of orchards and the setting up of warm air currents at airfields.

Chas. H. Capen
Ch. Engr.
No. Jersey Dist. Water Supply Comm.
Wanaque, N.J.

H. B. Shaw
Ch. Engr., Washington Suburban San. Dist.
Hyattsville, Md.

G. E. Arnold
Dir., Water Res. Div., N.P.A.
Washington, D.C.

E. H. Aldrich
V.P. & Ch. Engr.
Amer. Water Wks. Co.
Philadelphia, Pa.

Federal Activities Programmers

Chairman A.W.W.A. Committees

Entertainment
T. T. Quigley
Adv. Mgr., W.&T. Co.
Newark, N.J.

Transportation
E. A. Sigsworth
Indus. Chem. Sales
New York, N.Y.

Weather control was the subject of a report by Task Group 2.1.1 of the Advisory Committee on Water Resources Research. Dr. Irving P. Krick, Pasadena, Calif., Chairman of the Task Group, presented the report.

The stimulation of rainfall had its inception in 1946 with the patents and full scale experiments of the General Electric Company.

It is now established that clouds must contain water droplets at a suitable temperature and that ice crystals can grow rapidly by attracting water particles—the result naturally, as with artificial seeding to induce crystal formation, is that rain or snow will fall to the ground. Seeding experiments to date have been devoted largely to benefiting agriculture.

The Task Group has surveyed many sections of the country and finds a general belief that some years must elapse before laboratory results can be consistently duplicated on large scale. Experimental work has been carried on by the U. S. Weather Bureau since 1946. Federal, State, and local legislation to date is very limited.

Mr. E. Sherman Chase asked if any litigation were pending, and Mr. Krick stated several suits had been brought against the City of New York but all of these had been dismissed and he knew of none now pending.

Place of the Manufacturer in the A.W.W.A.

W. J. (BILL) ORCHARD, Gen'l. Mg'r. of Wallace and Tiernan, a past-president of the Water and Sewage Works Mfrs. Assn., and many years Chairman of A.W.W.A.'s Entertainment Committee, now Chairman of the Motivating and Policy Committee of the Manufacturers Association, presented a highly interesting highlight review of the history of A.W.W.A. and the W.&S.W. Mfrs. Assn., emphasizing their common interests.

In 1881 A.W.W.A. was formed in St. Louis, Mo., where the Association will meet to commemorate its 75th birthday in 1956. After nine years, the membership was but 400. The Water Works Mfr's. Ass'n. was organized in 1908 with 30 firms constituting the charter membership. Dennis F. O'Brien, president of A.

Management Division Programmers

R. S. Millar
Manager
Wichita Water Co.
Wichita, Kan.

M. P. Hatcher
Director
Water Dept.
Kansas City, Mo.

N. S. Bubbis
Genl. Mgr.
Water District
Winnipeg, Man.

Val Stephens
Director
Water Dept.
Fort Worth, Tex.

P. Smith Mfg. Co., served as first president of the Association. The A.W.W.A. Journal was first published in 1914 on a quarterly basis, became a bi-monthly in 1920 and in 1924 a monthly publication, with Abel Wolman as its editor.

Harry E. Jordan was drafted as A.W.W.A. Secretary and editor in 1936 when the membership was but 3,000. Fifteen years later under the "spark-plug" leadership of Jordan, the membership is closely approaching 9,000. In recognition of such achievement, and many more, the Directors in 1952 established the Harry E. Jordan Achievement Award fittingly voting Abel Wolman as its first recipient.

Returning to the Manufacturer's Assn., Mr. Orchard recalled that for 20 years that Association had borne all costs for entertainment in connection with A.W.W.A. conventions. Since 1929 A.W.W.A. has borne all expenses for entertainment, largely carried in the registration fee. The Manufacturer's Assn. in turn voted a $7,500 annual contribution to A.W.W.A. for the privilege of holding and managing the exhibits held in connection with conventions. Also, in turn, the Manufacturers were given the privilege of picking three of their members to sit on the A.W.W.A. Board with the 30 members representing the various Sections of A.W.W.A., and 7 ex-officio members.

Mr. Orchard stated that the sole purpose of the Mfr's. Ass'n. is that of operating and managing the convention exhibits, there now being six authorized annual exhibits, two being in connection with sewage works associations and four in connection with water works organizations. The relationship which exists between the manufacturer's association and water and sewage works operator's associations is not paralleled in any other industry, according to Mr. Orchard, and represents a most satisfactory method of serving the community of interests which exists between the manufacturer and user of water and sewage works equipment and materials.

Costs of Relocation of Water Facilities in Highways

Harry B. Shaw, Chief Engr., Washington Suburban Sanitary District, Hyattsville, Md., came out fighting for the just consideration of water utilities saddled with the expense of relocating water works facilities which utilities are required to undertake in the improvement of highways or streets. All over the country water utilities have been put to the expense of lowering or relocation of mains and hydrants incident to change in grade or location of highways without financial assistance for these undertakings which only the highway change makes necessary without improving water supply service. Cases were cited by Mr. Shaw. One, a small water utility with a gross annual income of $30,000, had to relocate mains at a cost of $15,000, amounting to $22.50 per customer. On the other end Omaha, Neb., had had to spend $100,000 for main relocations. The Wash. Suburban Sanitary Comm. had been saddled with a $32,000 expenditure recently and $36,000 previously—just a dead expense yielding nothing.

Mr. Shaw advocated concerted action on the part of water utilities directed to securing relief from Federal highway appropriations in the nature of reimbursement for the expense of relocation. Senate Bill—2585 (Keller Bill) if passed by the Congress will authorize Federal highway authorities to stand all or any part of the utility relocation costs. Mr. Shaw advocated the establishment of special committees in each A.W.W.A. Section to work through their congressman for support of the Keller Bill. The same attack should be planned at the state level to take care of situations wherein Federal funds would not be available.

G. H. Seig, Genl. Atty. for the Omaha Metropolitan Utility Distr., discussed the legal aspects from the standpoint of the easement enjoyed by any utility licensed or officially authorized to use the city streets. Supreme Court decisions have supported this stand on the part of utilities. It can be concluded on legal grounds that a utility once given the right to use the city streets for its facilities, this right becomes a property right, and the utility can not be deprived of such property rights on constitutional grounds.

Construction and Maintenance Controls

Gerald E. Arnold, Director, Water Resources Div., N.P.A., Washington, D.C., brought A.W.W.A. members up to date on materials control by the N.P.A. with especial reference to the water, sewage and industrial wastes field.

Mr. Arnold reported that all controlled materials have eased recently except for copper. The copper situation has gotten tighter because strikes in South America have reduced copper imports by 25%. In consequence, more attention should be given to the suitability of some of the plastic tubings for service lines as a substitute for copper tubing. As to steel, the situation will continue to improve unless a strike develops in the industry. In the latter case, steel will materially tighten again.

In reply to questions, Mr. Arnold stated that galvanized steel or wrought iron pipe should not be difficult to procure, but plastic tubing should not be overlooked as a possible permanent material considering the improved qualities of plastics being offered for water service. Lead pipe should not be difficult to obtain.

[Ed. Note: The latest developments and modifications in N.P.A. regulations affecting readers of "Water & Sewage Works" are carried in an article by Mr. Arnold on page 139 of our April, 1952 issue.]

E. H. Aldrich, V.P. and Chief Engr., Am. Water Wks. Co., Philadelphia, as a member of the N.P.A. Advisory Committee on matters pertaining to water supply and sewerage, voiced the opinion of many that the water and sewage industry is still not adequately recognized for its relative importance by those at the head of N.P.A. His experience with 125 water utility properties justifies this opinion. It was further his opinion that the controls applied to water and sewage undertakings has been unnecessary, confusing and delaying to a costly degree.

Mr. Arnold stated that recently all applications for construction materials had been acted upon within 2 weeks of receipt. Material relief had developed from the permitted

carry-over of steel allotments from one quarter to the next—i.e., the quarterly allotment could be used in a six month period rather than a 90-day period. The promised reclassification of water and sewage requirements under "Industrial" had not materialized. Such classification would simplify operations and liberalize requirements.

Getting Along With Mayors and Councils*

GEORGE W. PATE, Sr., Water Supt., Nickerson, Kansas, spoke of how many Kansas Utility operators use the Scriptures as a help in dealing with their employers and their customers. The governing body should always be given the credit for improvements and service; that is the greater part of their compensation. He recommended staying within the budget and having a surplus at the year's end, as this makes a governing body very happy.

Overservice to influential citizens is to be guarded against, as such things will develop trouble for a manager in the long run. Finally, by using the Golden Rule as a guide one can be assured of good relations with his Mayor and governing councilmen.

ROBERT S. MILLAR, Manager Wichita Water Co., Wichita, Kan., developed the subject of employee-customer relations by emphasizing that all differences should be reduced to a mutual understanding of the problem involved. Then, many times, a solution is reached automatically. Water Works Managers are generally in the middle between the governing body and the customer or employee. This means that often by getting the parties to reduce their thinking to the Golden Rule the problem is solved.

VIRGIL KNOWLES, City Manager, Sidney, Nebr., told of the problem of a quiet boom town that grew in 12 years from a population of 3338 in 1940 to 6672 at present. Water supply and sewers to supply such a growth created a great problem. However, the Water Department has been able to remain debt free during the period. The source of water is shallow wells (100 ft. deep) and no treatment is required. For old customers the minimum charge is $1.00 for 12,000 gals. per month, and for customers in new developments $2.00 for 24,000 gals. per month; all above the minimum amounts is at a rate of 5 cents per 1,000 gals.

The water main extension policy is divided into four alternates: City supplies main to sub-division, then developer operates all main in development; Developer runs main to sub-division and City operates all main in the area; where development is in scattered area City furnishes 100 ft. of main per house, the home builder completes main; or an area is set up in a benefit district with the District assuming all cost. The City negotiates the plan to be used.

The Flood Control Problem*

L. P. COOKINGHAM, City Manager of Kansas City, Mo., acted as moderator of this panel discussion.

In his opening statement he told of having been in Texas City a few hours after the disaster there. This experience demonstrated the need for a disaster plan and such a plan for Kansas City was being developed. However, when the 1951 flood hit, the plan was not on paper. The most important part of such a plan is the need for practice so everyone concerned knows what to do.

MELVIN P. HATCHER, Director, Water Dept., Kansas City, Mo., discussed "Establishing an Emergency Authority."

Authority from the governing body should be given to an operating group so that it has power to act in the emergency, take what steps prove necessary, and spend money needed to alleviate the emergency as quickly as possible. He cited the authorities set up in Kansas City, Winnipeg, and Fort Worth, during the several flood emergencies.

W. D. HURST, Chairman of the Winnipeg, Canada, Water District, read a paper prepared by Nathan S. Bubbis, General Manager of the District, discussing Notifying of the Public. Mr. Bubbis emphasized that planning was essential in developing a program to notify the public of any type of disaster. Communications must be cataloged so that they may be put to use in the shortest possible time.

M. B. Cunningham, Supt. & Engr. Water Dept., Oklahoma City, Okla., read UEL STEPHENS' paper on "Shutting Off the Plant." Mr. Stephens, Director, Water Dept., Fort Worth, Texas, covered various phases of shutting down a plant prior to a flood. One of the things stressed was the prevention of employees and volunteers from taking unnecessary risks. All power should be shut off from the plant and emergency lighting generators brought in for plant protection. Material should be stock piled ahead above the flood level so that it will be available for restoration use. Finally, consideration should be given to moving the plant to higher ground should this become necessary.

MAJOR C. HAGAR, City Manager, Sterling, Kansas, discussed "Emergency Water Supply." He also stressed that prior planning was very necessary, as it is too late to look for

*Papers presented in these sessions were reported by Major C. Hagar, City Mgr., Sterling, Kan.

President
Everett M. Jones
Sales Mgr.
Simplex Valve & Meter Co.

Pres.-Elect
Carl N. Brown
Asst. Gen. Sales Mgr.
U.S. Pipe & Foundry Co.

Manager
John Stewart
W. & S. Mfrs. Assn.
New York, N.Y.

Secretary
Dorothy Dimmers
W. & S. Mfrs. Assn.
New York, N.Y.

Water & Sewage Works Mfrs. Assn.

Manufacturers' Luncheon

Water and Sewage Works Manufacturers Assn. Meeting in Hotel Muehlebach

an emergency water supply after the catastrophe happens. Emergency supplies and their use should be planned and the plan kept up to date by reappraisal. It was suggested, from observations of the 1951 Kansas River flood, that it might be practical to pump raw water directly into the mains, providing the people were notified such water would be used only for fire protection and toilet flushing. Consumers must be instructed *to boil all water* used for drinking or cooking until the Public Health Authorities again certified the purity of the water. Any pumping of raw water to the mains should also be accompanied by heavy chlorination and great care should be taken in flushing lines before normal use again.

N. T. Veatch, Black & Veatch, Cons. Engrs., Kansas City, Mo.

Mr. Veatch described this as the worst catastrophe in the history of the area and the greatest flood within the period of authentic records. Other major floods occurred in 1844 and 1903, with data from the latter having been used in the subsequent design of bridges, levees and similar structures.

During the 1951 flood 150 miles of the Kansas River Valley were inundated. This included some 10,000 farms and 22,370 residences of which 2,480 were destroyed, yet the loss of life was only 25. The total flood discharge at Bonner Springs some 20 miles above Kansas City was estimated at 5,831,000 acre feet.

Dwight F. Metzler and Russell L. Culp, Kansas State Board of Health, and presented by Mr. Metzler.

On Friday, July 13, 1951 thirty-seven water treatment plants in Kansas alone went out of service due to floods, and previous crests were being exceeded by 6 to 10 feet.

Later analyses of the situation disclosed major power failures had occurred at 10 plants lasting an average of 11 days; at 6 plants low lift pump stations were out an average of 1 day; 11 flooded wells were out 15 days; 12 treatment plants out 13 days average; major distribution system damages occurred at 6 plants and 14 additional supplies were seriously affected. Mr. Metzler noted that the failure of drains and sewers under

Crowds in Kansas City

Conventioneers outside the Municipal Auditorium—they sat, they stood, and they lined up for plant inspection buses

Frank E. Willey, Production Engineer, City Water Dept., Topeka, Kansas discussed Restoring Service. This covered various problems of drying motors, cleaning pumps and piping, cleaning basins and sterilizing with strong chlorine solutions. The problem of repairing basins damaged by settling (by the use of bulk heads around the repair section) was detailed. Mr. Willey noted that for restoration under pressure the cost always is high. He also stressed the need for a stock pile of material above or away from the point of danger so that it would be available for restoring service.

Mr. Cookingham summed up the thinking of the panel when he said, "Planning before the disaster is the best insurance against confusion and will insure the quickest restoration of normal service." He also brought out the point that during the 1951 flood emergency the health of the citizens affected was even better than during normal conditions. Mr. Hurst of Winnipeg confirmed this statement, saying the same thing prevailed at Winnipeg.

The Kansas Flood of 1951**

What Happened? How Much Rain? How Much Stream Flow? was the title of a paper presented by

Mr. Veatch stated that the April 1951 rainfall on the Kansas River watershed generally was below normal; the May rainfall was slightly above normal; in July heavy rains over much of the area produced from 8 to a maximum of 16 inches; and with streams and reservoirs already full, intense storms occurred July 9-12 over wide portions of middle Kansas producing in places a maximum of over 17 inches rainfall. These storms were the result of warm moisture laden winds from the Gulf encountering a cold front from the north, a weather pattern responsible for many other floods in this region, including that of 1903.

In discussing control measures Mr. Veatch pointed out only five major reservoirs had been constructed on the watershed prior to 1951, the largest of which was full at the time of the July deluge. Furthermore had all of the multi-purpose reservoirs proposed for the area been completed at that time it is doubtful if they would have been effective in this flood. In his opinion the "dry dam" type reservoir plus additional control methods will be necessary to cope with floods of such magnitude.

The Flood and Water Service

Interruptions to Water Service: Quality and Treatment were covered in a paper prepared by

the abnormal flood pressures were so common and serious as to warrant future careful study.

In those communities with complete failure of service drinking water was the first major problem. Emergency treatment equipment consisting either of pressure sand filters, truck mounted, or of diatamaceous earth units unassembled was rushed to the area by various agencies including the U.S.P.H.S., Army and Red Cross, which agencies functioned quite successfully throughout the emergency. During this period effort was made to keep the public informed, use being made of press, radio, P.A. systems and hand bills. Excellent cooperation resulted both as to preventive and conservation measures.

Rehabilitation operations included chiefly the drying of electrical equipment, removal of silt and mud, repairing structural damages, especially to clear wells, and sterilization of distribution systems.

The authors summed up their conclusions as follows:

(1) Disease epidemics under such conditions can be prevented by rigid control. Not a single case of waterborne disease was attributed to the flood. (2) The public can and will cooperate if given the facts. (3) Truck or trailer mounted pressure sand filter treatment units are more satisfactory in such emergencies provided roads are available. Where

**Papers presented in this session were reported by N. M. de Jarnette, Assoc. Dir., Water Pollu. Control, Georgia Dept. Public Health.

plane or small boat transportation is necessary diatomaceous earth units are preferable. (4) Emergency equipment and supplies should be stored at several divergent points rather than in a single location. (5) Two way radio communication facilities are vital. (6) Good record maps, distribution system and plant plans are most essential. (7) Key Federal agencies can cooperate. (8) An improvised mutual aid plan worked well. (9) Flushing mains with 50 ppm. chlorine solution quickly restored them to safe condition. (10) Clear water storage reservoirs should be above flood stage. Drains below high water elevations proved costly. (11) More storage capacity at high elevations is needed. (12) More reserve chemical feeder capacity, especially chlorination, is needed. (13) Adequate valving of the distribution system is most important.

In reply to two questions by Mr. Abel Wolman, Mr. Metzler stated that (1) There were no regulations in Kansas to prevent rebuilding in the areas which had been flooded and (2) both the State Highway Commission and the Water Resources Commission had regulations pertaining to minimum openings under bridges but that some bridges antedated these regulations.

INTERRUPTIONS TO WATER SERVICE: PRODUCTION AND DISTRIBUTION was discussed by R. G. Kincaid, Burns & McDonnell, Kansas City, Mo.

He presented pictures portraying conditions in the Kansas City Metropolitan area where three distinct groups of consumers are located. (1) Those in areas where reasonably adequate service was maintained; (2) those in high or outlying areas without water at their premises but close enough to areas served to secure water for most basic needs; (3) those whose homes were completely flooded and who for the moment were confronted with more serious problems.

Mr. Kincaid reported water service was restored in the Armourdale District in about 12 days and in the last Kansas City, Kans., areas after 30 days. Throughout the flood the Kansas City, Mo., plant was able to deliver a minimum of 43 mgd., although the battle was won by an exceedingly slim margin. He emphasized the fact that ability to maintain some supply of usable water prevented almost certain chaos and mass evacuation of three quarters of a million persons which would have been necessary had the water supply failed completely.

The Flood and The Future

WHAT OF THE FUTURE was the subject discussed by A. H. Carhart, Conservationist and Author, Denver, Colorado.

He reviewed the role of water in modern civilization, the two fundamental uses being water to drink and water in the soil to grow food crops. Statistics quoted indicated the present population growth trend, coupled with loss of productive soil, is fast leading to a most serious national situation. He estimated that this country has already lost 100 million acres of productive farm land largely through destructive erosion by water.

Mr. Carhart deplored the futility of many past efforts to correct these conditions by construction of large reservoirs on the main-stem streams and pointed out the silting action which so frequently follows giving rise to the "masked" dam effect and up stream agradation of the channel.

The speaker outlined his conception of a well balanced water management program to start at the point where a rain drop first hits the earth and continue all the way down the basin, utilizing the absorption capacity of the soil on each watershed as a gigantic reservoir. To effectuate these policies he advocated a citizens water resources planning board for every minor watershed in the nation with representation on expanded boards for major drainage basins.

Mr. George Yackey, Manager, Fallbrook, California Public Utility District, requested permission to tell how military authorities are endeavoring to appropriate water rights vital to some 14,000 persons in his community in defiance of California laws and permits for water use issued by the State Water Resources Board. Mr. Yackey urged all water works men to support legislation now pending in Congress making compliance with state laws and regulations mandatory for all Federal agencies.

In answering discussion, Presiding Chairman Abel Wolman, noted that only one side of the case had been presented on the last two subjects. He also stated that perhaps Congress was exercising good judgment in taking time to study flood control measures for the Kansas River system rather than act too hastily.

Mr. Samuel B. Morris stated that copies of the report of the President's Committee on water resources were now available; that studies of existing conditions in each individual basin was needed to plan a flood control program; and that the costs of such projects should be borne by those who reap the benefits.

Charles H. Capen Receives Doctorate of Engineering Degree

Charles Herbert Capen, Jr., President of the American Water Works Association and Chief Engineer of the New Jersey District Water Supply Commission, was the recipient of an honorary Doctorate of Engineering at Newark College of Engineering's 36th commencement exercises on Friday, June 6, 1952 in Newark, N.J.

Dr. Capen has served in the state of New Jersey since 1919 when, two years after graduating from Cornell University with a civil engineering degree, he became Assistant Sanitary Engineer for the State Health Department. In 1925 he was appointed an Assistant Engineer of the New Jersey District Water Supply Commission and, in 1941, was named principal Sanitary Engineer for the United States Army, Second Corps area; appointment of Chief Engineer of the N.J.D.W.S.C. followed in 1942.

He is the Fuller Award winner in 1938 and received the James F. Lincoln Arc Welding Award in 1942. Cornell University awarded the Fuertes Medal in 1941. He has been a consultant on more than fifty water and sewer projects across the country. He is a member of the American Society of Civil Engineers, American Water Works Association, Federation of Sewage and Industrial Wastes, American Public Works Association, New Jersey Society of Professional Engineers and Rotary. He is a resident of Wanaque, New Jersey, site of the Ramapo River Project.

A Prayer

Father, when we long for life without trials and work without difficulties, remind us that oaks grow strong in contrary winds and only under great pressure are diamonds made.—The Rev. Peter Marshall, late Chaplain of the U. S. Senate.

The Carbon Monoxide Hazard In Water Recarbonation

Results of an Investigation and Recommended Preventive Measures

by RICHARD D. SCHAFER, *Industrial Hygiene Engr., Ohio Dept. of Health, District Office, Bowling Green, Ohio*

A RECENT investigation in Ohio of sixteen municipal water treatment plants employing the recarbonation process has emphasized the necessity of controlling the carbon monoxide hazard in certain types of installations using this process.

Initially the author was requested to inquire into the cause of illness of a municipal water softening plant superintendent who experienced, over a period of time, severe headaches, nausea, and dizziness. The superintendent finally collapsed while cleaning a filter but was able to crawl to the outside of the water plant building; medical attention was procured, and after three hours of care the superintendent was pronounced out of danger—a narrow escape! The diagnosis was acute carbon monoxide poisoning. Subsequent analysis of the workroom atmosphere showed concentrations of carbon monoxide varying from 200 to over 1000 parts of carbon monoxide per million parts of air.

As a result of this nearly disastrous incident, it was considered important to determine safety measures which are required in the design and operation of recarbonation plants in order to prevent hazardous concentrations of carbon monoxide, and to preserve the life and health of plant operators.

The Recarbonation Process

A lime-soda softened water usually is scale forming in the distribution lines unless precipitation of the unreacted lime is halted. One of the methods used to control this after-precipitation is to add carbon dioxide to the hydrated lime dissolved in the water, thereby forming soluble calcium bicarbonate.[1] For this purpose carbon dioxide may be produced in quantity, and at a low cost by the combustion of carbonaceous material, such as natural gas.

The reaction involves the combination of 1 volume of natural gas (methane) with 2 volumes of oxygen to form 1 volume of carbon dioxide plus two volumes of water vapor.[2]

In the plant where the accident occured, carbon dioxide produced by the combustion of natural gas is applied to the water in a chamber below the plant operating floor in the manner shown in the schematic diagram Fig. 1. It is apparent in this arrangement that, unless the recarbonation chamber is *gas tight and properly vented* to the outside of the building by a pipe of adequate size, products of combustion not completely soluble in water will be released to the room atmosphere; and, if at the same time the products are highly toxic, the stage is set for possible disaster. Carbon monoxide is just such a toxic gas!

Properties of Carbon Monoxide

In the event natural gas (methane) is burned without a sufficient supply of air, carbon monoxide will be generated in addition to carbon dioxide, and the amount of the former produced will increase as the quantity of air diminishes.

In this case the reaction proceeds as follows: 2 volumes of natural gas (methane) combine with 3 volumes of oxygen to produce 2 volumes of carbon monoxide and 4 volumes of water vapor.

Commercial gas burners usually operate to produce both the monoxide and the dioxide; however, by proper adjustment of the gas-air ratio, the production of carbon monoxide may be held at a minimum.

Carbon monoxide is soluble in water to a lesser degree than is carbon dioxide. One thousand gallons of water at 32°F. will dissolve 4.7 cubic feet of carbon monoxide, while the same quantity of water will dissolve 239 cubic feet of carbon dioxide. In addition, the carbon dioxide reacts with the chemicals in the water to produce non-gaseous water soluble products. As a result of the aerating water with a mixture of both carbon monoxide and dioxide, the less soluble monoxide will pass off at the water surface while carbon dioxide which is 50 times more soluble will remain in the water.

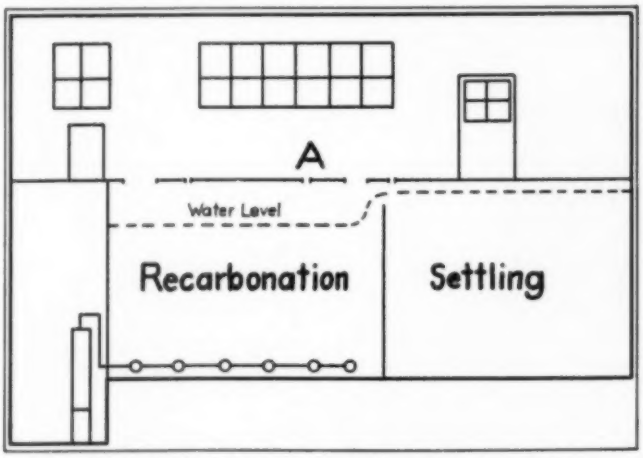

Fig. 1—RECARBONATION UNIT located inside water treatment building.
Note openings in operating floor under letter "A."
Sketch illustrates essential features of properly sized vent and gas tight manhole.
Note method of trapping gas at water entry on each side of tank.

Toxicity of Carbon Monoxide

Carbon monoxide is a colorless, odorless, non-irritating gas. If it is inhaled for a sufficient length of time, 100 parts of gas per million parts of air (ppm) will produce symptoms of poisoning. As little as 200 ppm will produce slight symptoms in several hours. Four hundred ppm will produce headache and discomfort within two to three hours. With moderate exercise, 1,200 ppm will produce slight palpitation of the heart in thirty minutes, a tendency to stagger in one and one-half hours and confusion of the mind, headache and nausea in two hours. A concentration of 2000 to 2500 ppm will usually produce unconsciousness in about thirty minutes. The effect of carbon monoxide in high concentrations may be so sudden that a man has little or no warning before he collapses.[3] The maximum concentration of carbon monoxide which may be inhaled for 8 hours (a normal working day) without causing ill effects is 100 ppm.[4]

A Survey of Sixteen Water Treatment Plants

In view of the near fatality in one water recarbonation plant, it was decided to study sixteen plants employing this process in order to determine if a similar problem existed.

It was found that the sixteen plants could be divided clearly into two types: (1) those wherein recarbonation took place in the same building housing all water treatment, and (2) installations wherein the recarbonation process was located in a separate building or outside the main water treatment plant building. It was soon learned that no carbon monoxide hazard existed under normal operating conditions in those plants where recarbonation took place outside of the main water plant building, and where the recarbonation process was open to the atmosphere; therefore, attention was concentrated on the plants in which recarbonation was carried on in the same building as the other water treatment processes. Only four of the sixteen plants were in this category.

Table 1 reveals the carbon monoxide concentrations determined at various locations within plants in which the recarbonation process took place in the main building.

It will be seen from Table 1 that a serious exposure to carbon monoxide has occurred in Plant A. In this plant the high concentration was due to an attempt to secure greater carbon dioxide production by increasing flame height far in excess of that for which the unit was designed. This resulted in a long yellow smoky flame from which copious quantities of carbon monoxide were generated. Due to the design of chamber and building, this gas had direct access to the work room atmosphere through loose fitting manhole cover plates and valve stem ports.

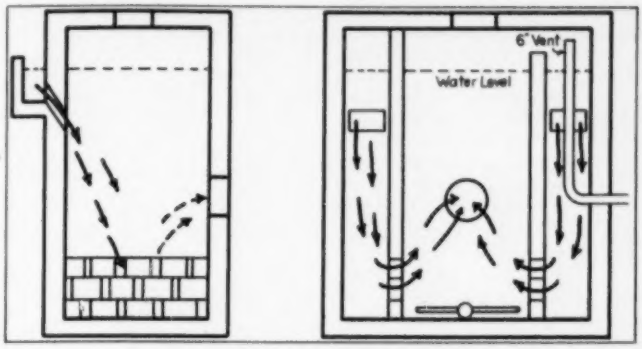

Fig. 2—GAS TIGHT Recarbonation unit.
Arrows indicate direction of water flow.

Although the concentrations in other plants was low or non-existent there still exists a very real hazard. Changing operating conditions, loose fitting manhole covers, necessity for emergency entrance into the carbonation chamber—any or all of these conditions may bring personnel in contact with concentrations of monoxide which are injurious to health — safe use of the recarbonation process within the water treatment plant requires vigilance!

Plant Operation and Design for Safety

In the event that recarbonation must be carried on in the same building as other treatment processes, then it is imperative *at all times* that the burner fuel-air ratio be maintained to produce a clean blue flame. If the demand for carbon dioxide is such that flame height must be increased beyond the point where an adequate supply of air is obtainable, then the only remedy (if carbon monoxide production is to be prevented) is the installation of a larger unit.

Instruments are available from the United States Safety Service Company and the Mine Safety Appliance Company which may be used to quantitatively determine the concentration of carbon monoxide in air. These employ indicators which measure concentrations of carbon monoxide from 0.001 to 0.1 per cent, the quantity of carbon monoxide being determined by comparison of the color developed with a standard color chart. The instruments are hand operated. They should prove useful to indicate the fuel-air ratio productive of minimum carbon monoxide generation.

Proper design for safety is of equal importance if recarbonation chambers are to be located within water treatment plant buildings. Safety dictates that the recarbonation chamber be gas tight and effectively ventilated to the outside of the building. The vent should be so located that carbon monoxide gas can not re-enter the plant through open doors or windows. Furthermore, this vent must be placed so as to preclude reversal of gas flow due to wind and weather conditions. Fig. 2 illustrates a design which incorporates these safety features.

In the event that an accidental discharge of carbon monoxide into the water plant building occurs, means should be provided to dilute the gas to a safe level. This may be accomplished by providing general

Table 1

Plant	Test Location	Carbon Monoxide in ppm.
A	Influent valve stems	1000
	Openings in floor	400
	Air space over recarbonation chamber	over 1000
	Vicinity of operator's desk	200
	In basement around recarbonation tanks	0
B	General atmosphere over recarbonation chamber	Trace
C	General atmosphere over recarbonation chamber	25
D	General atmosphere over recarbonation chamber	0
	Air space in recarbonation chamber	300

ventilation by mechanical means, and should be designed to produce six air changes per hour in the work room space.

Personnel Safety

The safety of operating personnel may be endangered either by the presence of small quantities of carbon monoxide continually present in the air of the water plant or by exposure to high concentration for short periods.

The presence of low concentrations of carbon monoxide may be detected by one of the commercially available colorimetric carbon monoxide indicators, and the safety of persons may be assured by proper ventilation continued until the source of the gas entering the building is located and sealed.

Unexpected exposure to high concentrations may require immediate measures to preserve the life of an operator. Therefore in each water plant there should be posted *in a conspicuous place* the symptoms of carbon monoxide poisoning, emergency treatment procedure, and the telephone number of physician to be called.

Occasionally it may be necessary to perform emergency maintenance work or to enter a tank or building to rescue a person overcome by carbon monoxide. Personal respiratory protection can be secured while accomplishing such tasks, by means of one of the following self-contained respiratory protective devices: air-line respirators, hose masks, and carbon monoxide gas masks. Where the task to be performed requires exposure to only moderate concentration of carbon monoxide for short periods of time a properly fitted carbon monoxide gas mask will provide the necessary protection at nominal cost. At least one of these personal respiratory protective devices should be available in every water plant employing products of combustion for recarbonation purposes.

Summary

Conditions in sixteen municipal water treatment plants utilizing carbon dioxide for water recarbonation were studied. In one plant, the concentration of carbon monoxide on the main operating floor was hazardous. Improper fuel-air ratio in the burner, ill fitting manholes in the top of the recarbonation chamber and lack of proper gas vent to the outside were primarily responsible for the dangerous condition. Operation of fuel burner to give clean blue flame, gas tight recarbonation chamber, and adequate chamber vent to outside are necessary to prevent serious accidents. All recarbonation plants should be equipped with emergency respirators for protection of operators.

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"Jo" Lufkin is Dead

Truly an "Ambassador of Commerce" and Gentleman of the Old School

Joseph Garland Lufkin, first, last and always a New Englander, was born in Gloucester, Mass., Dec. 27, 1868, and died March 30, 1952. He was in his 85th year, sixty-six of these years having represented his tenure of connection with the water supply industry in one or another capacity.

"Jo" Lufkin was a descendent of the earliest settlers of Gloucester. His father, Eben H., operated a blacksmith and wagon shop there. "Jo's" first position on his own was that of clerk in the Gloucester, Mass., Water Dept. in 1886, and thereafter entered the employ of the Norman Co., water works contractors. In 1892 he entered the employ of The National Meter Co., of Brooklyn, N.Y., as New England's first water meter salesman. His was the job of selling the advantages of water metering in the New England States and the eastern Canadian provinces. This territory he covered by train, horse and buggy, and sleigh, until the advent of the automobile. In 1914 Mr. Lufkin was made N. E. Mgr. for National Meter, which position he held until his resignation in 1941 to go into business for himself—almost 50 years in the meter selling business.

In 1923 Mr. Lufkin established a partnership with Henry L. Weston and Morton L. Miller to manufacture brass-goods for the water works field under the name of "Red-Hed" Mfg. Co., of Boston. Upon retirement from the water meter sales field Mr. Lufkin became president of the "Red-Hed" Co., which position he held at the time of his death.

"Jo" Lufkin had many tales to tell of the vicissitudes of a pioneering water-meter salesman. His first sales trip was to Portland, Me., when in 1892 he sold his first meters. His last trip was also to Portland to attend the 1952 meeting of the Maine Water Utilities Assn. In the matter of attending water works meetings, he held what is thought to be a record for attendance. His first meeting was that of the New England Water Works Assn. in 1892, since which his record over the 59 years intervening was 100% attendance except for one annual meeting. His record in the Maine Assn. was likewise 100% except for one winter meeting in Portland.

In New England those salesmen who have conducted themselves as had "Jo" Lufkin, they call "Ambassadors of Commerce" and he justly deserved this designation. He was first, last, and always a gentleman of the old school; admired, trusted, and beloved by many.

Mr. Lufkin was a life member of the Gloucester and Arlington Lodges of Masonry; a member of the St. Andrews Royal Arch Chapter and the Boston Council of Royal and Select Masters. He had long been an active member of the Universalist Church and Trustee of the Bethany Union for Young Women. He leaves a daughter and four sons, one of which (Eben D.) was with his father in the meter sales business and since has become Treasurer of the "Red-Hed" Mfg. Co., of Boston. Succeeding Mr. Lufkin as president of the company is one of his original partners of 1923—Henry L. Weston.

It was with regret that we did not know of the passing of "Jo" Lufkin until too late to get this item ready in time for our June issue. Widely known and admired in the New England States, his passing is deserving of something more than ordinary mention, as this memorial will reveal.—The Editors

Water Rates

With Especial Reference to Charges for Private Fire Protection

by PIERCE BAILEY, *Engineer, Division of Water, Toledo, Ohio.*

THE Ohio Section of A. W. W. A. at its 1951 meeting selected a panel who conducted an open discussion of "Water Works Problems." The writer, a member of this panel, undertook to answer the question "Are Our Water Rates Obsolete?"

It was assumed that such a question was meant to be general and not for any specific case. Recognizing the fact that many cities and communities, during the past four or five years, have joined the "select" group and have adjusted their water rates to meet the times, I feel that very little can be said about the benefits received. However, the truth is that this is still a minority group.

It is not difficult for an administration of any water works to determine the inadequacy of their present rates. A glance at the financial statement will disclose this all too clearly. The normal reaction to this disclosure is to increase rates.

Increases Percentage-Wise Is Not Sound

To increase water rates on a percentage basis will compound existing inequalities in the rate structure, which has resulted from its use for any extended period with no recognition of changes in demand trends or consumption requirements in the community served. For instance, this is true where a rate was originally designed to provide adequate revenue on the basis of water consumed in the ratio of 2 to 1 for small and large consumers, respectively. Today, this ratio may be reversed. A local water works may find that sixty per cent of its capacity is utilized to produce and deliver the requirements of one large industry located in its community. This and many other conditions may prevail and cannot be actually observed, or revealed, until a complete and thorough study is made of the financial and operational set-up of a water works business. Only a thorough investigation will reveal facts, which, in the presentation of the need of a new rate structure, will eliminate the hazard of conjectures. It is always advisable to anticipate public reaction before presenting a new rate structure. There seems to be no particular yardstick for this type of modification; it is largely dependent upon the use of sound judgment and the knowledge of local conditions.

Fire Service Charges

Today, the consideration of new water rates has placed emphasis upon "Fire Service" charges, both public and private. Who to charge, and how much?, seems to be a burning question, for which there is no ready answer available. Surveys conducted on existing charges indicate a wide difference of opinion. Recent discussions among water works men reveal the issue to be highly controversial. It is the writer's opinion that charges for this type of service, based upon direct benefits received, is hardly the correct approach. "Fire Service" is a protection for the entire community and, as such, becomes a community obligation. Losses sustained by a fire, whether it is in industry or in the home, is a loss to everyone in the community, either directly or indirectly.

There is a justification for "Fire Service" charges in the case of private lines or hydrant connections. Such charges should be nominal and based upon a "stand-by" or "ready-to-serve" charge. I have found, after careful study and consideration of all current factors involved, that a nominal private "Fire Service" charge, within the range of $0.50 to $1.00 a month per inch diameter of service connections and $6.00 to $12.00 a year for hydrants, to be equitable. I believe that rate structures set up today, incorporating charges within the above figures, will be justified in the majority of instances. I cannot approve, or justify, charges that are so high they have a tendency to prevent, or delay, added fire protection to a community or concern. The fact that a large industrial plant is able to reduce its fire insurance premiums by several thousands of dollars by virtue of added fire protection, does not, in any sense, justify the local water works to take advantage of these savings or consider that any part of such savings should be paid out to the water utility. The purification and sale of water is, in the broad sense, a "business" and not a "racket." The economic foundation of a community is enhanced by additional or improved fire protection, whether it is for industry or the home.

Illegal use, or leakage, of water on private fire lines is a familiar charge and often times a fact. However, in most cases, I do not believe it is intentional. In any event, charges for private fire service should not reflect this condition for it then becomes a penalty against everyone, whether or not water is used illegally or leakage is present. The correction of the illegal use of water and leakage should be remedied by an administrative policy inflicting a penalty in those cases where it is found, beyond reason of doubt, to be intentional, or, in those instances, where there is a failure to correct a condition once it is revealed.

In conclusion, a review of existing water rates with regard to adjustments reflecting equitable charges, should have as its basic approach the same principles and policies used in conducting any sound business venture, with special consideration to changing times, community welfare, and any other factor, present or future, which may affect the commodity in question or the reputation of the water works industry for fair dealing and equitable treatment of its customers.

Of marked importance to the well-being of the water works industry is the matter of adopting a realistic policy in respect to rate patterns and methods of charging industry for private fire protection standby service.

This article by Pierce Bailey, who thinks more in terms of fair business principles and less in terms of monopolistic dealings, results from having heard his forthright arguments as a participant in the Ohio Sections "This I Believe" panel.

If Mr. Bailey's article has the tone of an editorial "On practicing the Golden Rule in water utility management," that is exactly what we wanted when prevailing upon him to put his remarks into form for publication in *Water & Sewage Works.*—

Operation of Small Water Works

Income and Outgo

by A. E. CLARK, Manager, *Nashville Suburban Utility Distr., Nashville, Tenn.*

THERE is one basic principle in business and that is, the income must exceed the outgo if the business is to survive. There is an apparent discrepancy in the thinking between some of the economists when the above principle is applied to the largest business in the country with headquarters on the Potomac; however, for the purposes of this article the opening statement of fact will be assumed to have been long established. A water utility is no different from any other business and if business principles are applied there is no logical reason why the utility should not be self supporting. There are reasons why some are not, but usually due to other causes.

A water utility like any other business will not run itself and requires a responsible person to head it up. The administration, operation and maintenance requires adequate funds with which to do the necessary work and it has been the writer's experience that these funds can be available provided (1)—the water rates are such as to provide the needed revenue; (2)—that the funds can be used by the utility for all needed expenses; (3)—that the funds are properly administered.

Where Do We Stand on Rates?

Water rates are receiving a great deal of attention during this period and rightly so. A casual study of all commodities shows that increased costs have gone up around 100%. How many water utilities have increased their rates that amount if at all? Materials, equipment and labor have all increased in the same proportion as far as the water utility is concerned. When a rate increase is considered a campaign is started to convince the consumers that an increase is justified and many times the increase is made against considerable opposition, but the same individuals who oppose it will purchase a new automobile at double the price that they paid ten years ago without any quibbling. As an analogy, the automobile is a necessary piece of equipment; however, an individual could get along without it. Water, on the other hand, is more than necessary, we cannot exist without it. It is the cheapest commodity and service purchased by the consumer today. There seems to be a psychological element in the majority of people which makes them react against fair charges for the most important product and service they purchase. Nevertheless, regardless of their attitude, the operation of the water utility must continue under any and all conditions and if the consumers are to receive it, then sufficient funds *must* be obtained to give it to them.

The majority of consumers have a very dim view of what it takes to give them good water service. Pumping stations, purification plants, distribution systems, fire hydrants and storage facilities are expensive as well as their operation and maintenance. If there is a main break and it is necessary to cut off the water from a number of consumers the utility hears about it immediately with the usual question: "When will we get the water on?" Do the consumers think that the break can be repaired without charge? What about power costs, chemicals for the treatment to provide them with the best possible water, the necessary number of employees to operate the system twenty-four hours a day every day? There are not any holidays for the water utility as a whole. So, if they expect the service they must pay for it.

What Is an Equitable Charge?

What is an equitable charge for water service and how is it determined? Much has been written relative to arriving at an equitable charge but there is apparently no uniform procedure used at the present time. Many water utilities can determine their own rates without having to receive approval of any commission or other body set up for the purpose of passing on rates. Others must present their request for increased rates with supporting data to the proper authorities for review. Regardless of how an increase in rates is obtained the water utility must receive sufficient funds to take care of administration, operation, maintenance, taxes or tax equivalents, debt service and some surplus for the extraordinary expenses.

During these times every effort has to be made to keep costs as low as possible and continue to furnish the best possible service. This is difficult to do when nearly all cities are experiencing relatively large expansions with attendant expansion of the distribution systems, larger pumping and purification facilities, etc. Some of the work can be done with available funds, but in most instances where a large outlay of money is required a bond issue is necessary. This either adds a debt service or increases the present one. The bonds issued are usually general obligation or revenue bonds. The general obligation bonds can be a direct charge against all property owners in a city if the revenue from the water department is not sufficient to carry the debt service. The revenue bonds are a direct obligation against the water utility and their marketability depends on the financial structure of the utility. In other words, the income of the water utility must be sufficient to carry all the debt service as well as all other charges against it. The writer thinks the financing by revenue bonds might afford a little more protection to the water utility funds and possibly act as a deterrent to the transfer of funds to the general fund in the case of a municipality.

Too frequently the municipal governing body will have funds transferred from the water department to the general fund when the water utility can ill afford to lose any of its revenue. If the water department is able to accumulate a surplus over and above all expenses, as well as projected improvements, then a transfer to the general fund may be in order, providing a limit is set and above which funds cannot be transferred legally.

Buying Practices—and Savings

As stated above, the cost of operating water utilities has increased in proportion as all other goods and services have increased. Many of the

smaller ones have had rather rough going, due in part to difficulties in getting the rates raised sufficiently. There are, however, other factors which enter into operating costs. Purchase of materials is an important item and one which needs to be watched. Considerable savings can be made if purchases are anticipated so that advantage can be taken of a favorable market. The needs of various items required over a period of time if purchased in quantity will many times effect quite a saving against purchasing only for immediate needs. In order to do this some information must be obtained in regard to market conditions, not only now, but what is the general opinion as to conditions six months or a year from now. It is not good practice to build up too large an inventory, but it is advantageous to carry an inventory consistent with anticipated expansion. Accounting for the use of all materials purchased is another important item to watch. It is all too easy to take inventory and find that it does not check anywhere near closely. Then the question arises, where did the material go. Every job should carry its own labor as well as material charges. If properly kept, the inventory usually checks with reasonable closeness.

Payrolls

Payrolls are another important item. There is a minimum number of employees required for the efficient operation of a water utility and each must know his or her duties. Without proper management by one familiar with water utility operations there are numerous opportunities for increasing costs unnecessarily. A knowledge of all the operations is required even though a familiarity with the details is lacking. These can be taken care of by the foreman. It is all too easy to carry an excess number of employees and sometimes the water department is hampered by the necessity of employing appointees not fitted for the work. The manager should be allowed a free hand in employing and terminating the personnel, keeping the number in proportion to the work in progress. In other words, the temporary employees are exactly what the term implies. When they are no longer required they are terminated.

Transportation

Transportation costs must be watched. These costs can also get out of reason. This is usually the field superintendent's or foreman's job. His first duty is to see that the crew or crews are ready to go at starting time. His second duty is to see that they have everything on the truck for the particular job or jobs to be done, and of course his third duty is to see that the job or jobs are done right and completed in a reasonable time. If a number of calls are to be made by one truck, then it should be routed so that there will be no back tracking. Here again, a little thought will save trips back to the shop for some item which should have been on the truck. Each piece of working transportation equipment should be equipped with a standard set of tools and materials, so that small jobs can be done during the regular course of trips. Each should be equipped so that the tools and materials can be kept in bins or some similar arrangement and all tools and materials charged to the trucks.

Maintenance and Repairs

Maintenance costs are most important and can become a large factor of expense. Proper maintenance pays off both in time and money. Too often operating equipment obviously in need of attention is continued in use until a major breakdown occurs. This usually means time delay and more expense than if, when the trouble was first noticed the proper repairs were made. Operating equipment needing lubrication for example and most of it does, should have a rigid schedule set up whereby it will be lubricated with the proper lubricant and within the time interval set.

The above are just a few of the relatively large number of items which must be watched in the operation of a water utility and the manager should have an overall picture of the operations, both office and field, applying the same principles of business to both in order that a high standard of service is maintained consistent with economy and efficiency.

Income and outgo are the basis of any business and it requires constant attention and good management to keep the income ahead of the outgo.

"Mel" Hatcher Captures A.W.W.A. Golf Cup

His for Keeps, Having Been Only Three-time Winner in 35 Year History of Cup

Melvin P. Hatcher, Kansas City's Director of Water, has done what seemed to be almost the impossible —namely, to get his name on the A.W.W.A. Golf Cup three times. He had been winner of the A.W.W.A. tournament in 1947 and again in 1948, then a gap of four years until the 1952 Kansas City Convention when he won the cup for the third and final time. *Is he proud?* Says he worked hard for this three-time win during a number of Conventions.

The cup has been in existence since 1917 when won by George Peacock. It has been won by the following eight contestants twice but never before three times.

C. L. Kirk (1918) (1922)
W. D. Hess (1920) (1926)
Tom Dix (1925) (1929)
Peter Diederich (1928) (1936)
S. L. McClintock (1930) (1932)
John Laboon (1933) (1950)
Harvey Jones (1935) (1941)
Fitz. Salter (1938) (1939)
"Mel" Hatcher (1947) (1948) (1952)

Paired with Hatcher in the foursome at Kansas City was "Doc" Kincaid of Burns & McDonnell Engrs. Their opponents were Harvey Howe and Malcolm Hirsch of Lock Joint Pipe Co.

Public Service Commission To Value Water Property

The New York State Public Service Commission recently ordered a public hearing at Buffalo in the Erie County Water Authority's action to acquire through condemnation the privately owned Western New York Water Company.

The hearing, first ever undertaken under a law enacted this year, is designed to determine that the Water Authority does not pay an excessive price to the owners of the private water utility.

The Authority opened negotiations with the water company in late 1950 but they broke down in April, 1951, when the company rejected a $6,100,000 offer for all its properties. The company indicated in June, 1951, that it would sell for about $11,700,000 and claimed it could get between 14 and 22 million in a condemnation proceeding.

The Use and Abuse of Equipment in Small Water Treatment Plants

by DAVID E. BARRY, *Asst. Sanitary Engr. (R), U.S.P.H.S.,* Columbus, Georgia*

DURING the Sanitary Engineers' Training Courses conducted by the Columbus Field Training Station, the author makes frequent inspections of some eighteen water supply systems in neighboring communities. For the purpose of this article, these plants are classified as follows:

Group I —Systems having more than one full-time employee

Group II —Systems having only one full-time employee

Group III—Systems having only part-time employees

The seven systems of *Group III* furnish the data upon which this article is based. The municipalities served by these seven systems vary in population from 473 to 1497. All are small farming centers, all but two are county seats. Three of these systems use surface supplies; four use ground water supplies.

All three surface supply systems are equipped with treatment plants employing coagulation, sedimentation, rapid sand filtration, pH control, and chlorination.

Two of the ground water systems have no treatment whatsoever; one is equipped for aeration for iron removal, coagulation, sedimentation, and rapid sand filtration; and the fourth employs aeration for CO_2 removal, pH control, and chlorination.

Table I shows the size of each municipality, type of supply, and treatment, if any.

Operating Personnel

As has been indicated, all systems in this category are operated by part-time personnel. The operator at Municipality "D" is also employed in the city electric plant, while the operator at Municipality "G" doubles as school bus driver.

The operators at all other municipalities are members of the police force. The operator at Municipality "B" is undoubtedly the most versatile of the entire group. In addition to his job as water works superintendent, he serves as chief of police, fire chief, superintendent of the sewerage system, sewage treatment plant operator, and superintendent of roads and streets!

The operators generally consider the water supply job a secondary one, and apparently none of them has attended short courses in water works operation, or has otherwise attempted to improve his status professionally. Due to limited numbers of personnel, assistance from state and regional health department engineers is necessarily at a minimum.

Mechanical Equipment, Installation, and Maintenance

In general, the mechanical equipment found in these six plants can be grouped into three categories: (1) pumps; (2) gages, valves, and flow control devices; and (3) chemical feeders. These categories will be discussed, and suggestions will be made toward correcting or eliminating their shortcomings.

Pumps. All the pumps being used seem to be giving top-level performance. They appear to receive the best maintenance of any of the equipment in the plants.

The vertical turbine pumps have one common defect in installation. The air vents located in the base usually are street ells, unscreened, and unprotected from oil and grease. At Municipality "B," there is no street ell, the vent is plugged with a rag, and the air intake space is the gap between the pump base and the broken and ragged surface of the concrete pump pedestal. This surface is incredibly dirty, covered with dead insects, grease, oil, and other debris. The suction formed when the pump is started is almost certain to pull this material into the well.

Gages, Valves, and Flow Control Devices. The plants under discussion are sufficiently small so that all valves are manually operated. In general the plants are in satisfactory condition. At Municipality "E," small operating tables have been installed and, for space conservation, valves are connected with operating handles through two universal joints and a shaft. These shafts have sheared in a few instances, and valves are opened or closed from the gallery floor rather than from the operating floor.

All pressure gages and depth gages are in good working order. Of the loss-of-head-gages employed in four plants, one is disconnected, one is inoperative, one will be disconnected when the operator "gets up enough nerve," and the fourth is a simple and foolproof arrangement which probably will continue to work until the plant is abandoned.

Flow control devices consist chiefly of rate-of-flow controllers on the filters. As has been mentioned, two of these have been removed, and one probably will be disconnected in the very near future. The fourth is in good working order, and will probably stay that way, inasmuch as equipment at this plant receives better than average maintenance.

Chemical Feeders. Chemical feed devices generally are poorly maintained, but at all plants they seem to be working satisfactorily. General construction of most devices is sound, and usually they can be relied upon for good service during years of use and abuse.

The plants using gaseous chlorine present a notable exception, however. Operators frequently are careless in handling chlorine, losing gaskets, and not thoroughly tightening joints. The effect of damp chlorine is so well known as not to warrant further discussion. In the plant at Municipality "C," the chlorinator has been rendered completely inoperative by corrosion from wet chlorine, and the

Table I

SIZE OF MUNICIPALITY, SOURCE, AND TREATMENT

Municipality	Population	Type of Supply	Treatment
A	1497	Ground	None
B	1210	Ground	None
C	1161	Ground	Aeration, pH Control, and chlorination
D	928	Ground	Aeration, coagulation, sedimentation, and filtration
E	861	Surface	Coagulation
F	683	Surface	Same as E
G	473	Surface	Same as E

*Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Ga.

chlorinator at Municipality "G" is heavily corroded. At Municipality "F," the chlorinator is too new to have received any serious damage, although free gaseous chlorine has been noticed in the atmosphere on each of the last few visits. Unless something is done to correct this situation, an expensive piece of machinery will soon be rendered useless.

Hypochlorination as practiced at Municipality "E" seems to cause little or no damage, and seems highly advantageous for small plants.

Summary and Conclusions

The author's experience in small plants, visited as a part of the regular training course at the Columbus Field Training Station, has led to the following conclusions:

(1) Small communities seldom are willing or able to furnish adequately trained water treatment plant operators.

(2) Operators usually are burdened with so many duties that, despite a conscientious attitude, they may be unable to maintain adequate standards of operation and maintenance.

(3) Operators in small plants frequently are uninformed as to the purpose certain equipment plays in plant operation and, therefore, are unable to judge adequately the importance of each piece of equipment.

(4) Mechanical equipment originally installed may be removed or disconnected from service by the plant operator.

(5) Equipment repair or replacement by an operator who is unaware of its importance cannot be justified.

(6) For installation in small plants, simple devices are to be preferred and can be devised.

(7) These simple devices can be installed so as to require a minimum of maintenance, as well as at extremely low cost.

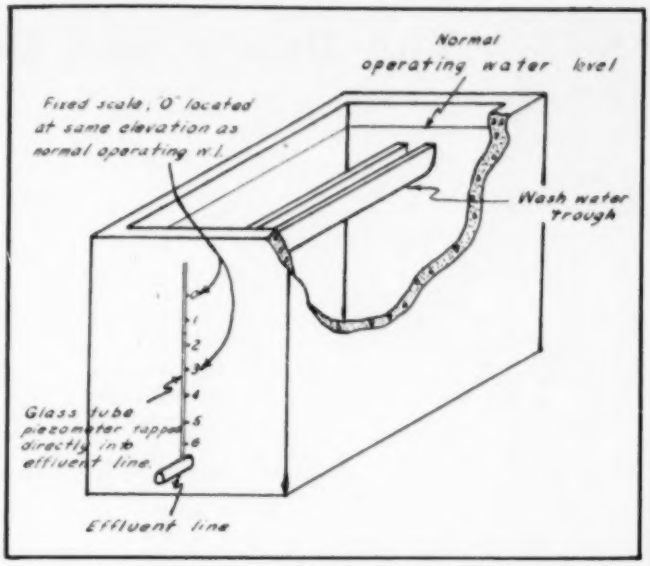


Fig. 1—Sketch of Sand Filter, Municipality "E"

Note glass tube loss of head gage on effluent line; scale markings indicate feet below normal operating level. Illustration indicates 1.5 ft. loss of head.

(8) The savings engendered by incorporation of these devices may be sufficient in amount to encourage more small towns to build water treatment plants.

(9) The corrosive action of chlorine must be recognized, and the fact must be remembered that operators with little or no training will be handling this toxic and corrosive element. Accordingly, the advisability of using hypochlorite and solution feed devices in small plants should be considered during early plant design stages.

(10) This article is not intended as a criticism of mechanical equipment *per se*. It is felt that the use of complex mechanical equipment has frequently been injudicious, and that simpler devices will prove more satisfactory *in small installations*. Large plants, those in which *adequately trained* operating and maintenance personnel are available, will continue to benefit from the use of complicated mechanical equipment.

The manufacturers of mechanical equipment have helped advance the science of water treatment to its present stage of development, and the importance of their role cannot be overemphasized. However, manufacturers always specify the need for adequate maintenance of their equipment.

In small water treatment plants of the type discussed, mechanical equipment seldom will receive adequate maintenance—and designers of such plants should recognize this fact. Simple equipment generally will be the best operated equipment. The public served by a small plant utilizing simple equipment is, therefore, most likely to receive a safe and palatable water.

How to Make a Bolt More Elastic and Less Likely to Break*

Fig. 1 pictures a bolt that broke at the root of the last thread, as shown. It broke because it was not sufficiently elastic. And it broke at the root of the thread because that was the weakest point in the bolt.

Fig. 2 shows how the fault was remedied—by threading the entire length of the bolt. By threading the entire length the total stretch does not concentrate on a single thread as was the case in Fig. 1. In Fig. 2 the stretch is distributed over the roots of all the threads. As a result the bolt is much more elastic and tougher and less apt to break.

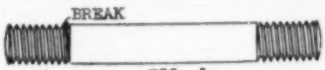


FIG. 1

FIG. 2

Another method is to turn down the shank of the bolt between the threaded ends making the unthreaded portion smaller in diameter. It is a good method, but many mechanics do not possess lathes whereas they do possess threading tools for doing the job as shown in Fig. 2.

Some people are like blotters—they quickly soak it all in, but get it all backwards.

*Contributed by W. F. Schaphorst, M.E., Newark, N.J.

The Utility and Good Relations

Some Viewpoints and Suggestions from an Interested and Helpful Newspaper Editor Who Practices What He Preaches.

by M. CARL ANDREWS, *Editor, The Roanoke World-News, Roanoke, Virginia*

THE 1952 session of Virginia's General Assembly was barely under way when a bill was dropped in the hopper of the Senate which would have restricted telephone companies to a net profit of five per cent. The fact that the measure was designed to bring about a constitutional amendment to this effect through a long ignored section of that constitution is a mere sidelight. It was aimed at the very jugular vein of a great public utility.

If ever enacted into law such a proposal would have been an entering wedge for eventual destruction of the privately-owned utility in the Old Dominion. By holding to a bare five per cent margin the profit from which come dividends to stockholders and funds for continued expansion it would have effectively stunted any future growth.

Utilities are Targets

The Chesapeake and Potomac Telephone Company of Virginia, largest in the State, was the natural target. Because it was in the position of not having asked a rate increase from the State Corporation Commission in more than a decade its profits already were down around the five per cent mark. To provide for expansion of facilities it needed higher rates.

More than half of the State's 24 cities declined a League invitation to join in opposing the application. Why? For the very same reason the five per cent profit-limit bill was doomed to failure: good public relations on the part of the Chesapeake and Potomac.

The C. & P. has always followed a policy of laying its cards on the table and taking the public into its confidence. It never makes a vital move like asking for higher rates without going to the newspapers and telling the story. It backs its news releases with clear, concise, attractive advertisements which catch the reader's eye.

People are essentially fair. Tell them the truth and the whole truth without trying to cover up and they will believe you. Not only that, but they will fall in line with what you are trying to do for them.

Profitable Public Relations

The public, being made up of average men and women, hates worse than anything in the world to be taken for a sucker or a dumbbell. Mr. John Q. is still suspicious of utilities because of past experience. Who can blame him? I cite the C. & P. case because it is a good example of what intelligent public relations can do for a company.

THE AUTHOR

M. Carl Andrews has been with the Times-World Corp. since 1929. He served three years in the U.S. Naval Reserve during World War II (Lieutenant-Commander). Since return from service in 1946 he has been Editor of The Roanoke World-News. Mr. Andrews is a graduate of the College of William and Mary, and is a member of Phi Beta Kappa and Omicron Delta Kappa. He is weekly radio commentator on State and Local affairs for WDBJ and is past president of the Rotary Club of Roanoke.

Which leads me to the question: What are public relations? To me, they are the process, both visible and invisible, by which a company, business or industry cultivates the good will and esteem of the people it serves. This process consists of telling the customers what makes your business tick, why they need you and what you can do for them. It consists, too, in trying without appearing too obvious about it, to get the public to work with you to the end that it shall be better served by you.

Let's Talk About Water

Because our readers here are concerned primarily with water, let's talk about water. It is one of the things the public can't get along without. Not everyone has a telephone. They even can get along in elemental fashion without electric power. Not everyone has gas, either, but everybody has to have water.

Does that mean, then, that water companies, both privately and municipally-owned can skip this business of public relations? Well, hardly. They ought to have the best they can get. It's not a question of affording it.

You can't just say to yourselves, "well, they have to have water so that's that." It isn't that simple, although some companies undoubtedly try to make it appear that way. Because necessity is involved there is all the more reason you should enjoy the good will of the consumer and that he should know all you can tell him about the business of producing and distributing pure water.

Power and gas companies as well as telephone outfits especially recognize similar necessity. We know that most, or a large proportion, do a good job of telling their stories. Collectively they spend millions on it every year. They use newspaper, radio and magazine advertising extensively. But even they do not have perfect records.

Why do so many utilities have poor histories in this matter of public relations?

First of all, because somebody in authority, somebody at the top, fails to realize the value of public good will. He fails to recognize the fact that a utility is a public servant, whether publicly or privately owned. As far as the privately-owned company is concerned, management needs to relegate to secondary importance the idea that its underlying purpose is to make money for the stockholders or investors. Whenever it ignores this public relations suffer. Of course profits are essential but they don't have to be brutally obvious. Can you think of any firm with top-notch public relations which has gone or is going on the rocks?

Informing the Public

Does your company take its customers into its confidence with regularity? I don't mean just publishing annual reports. The people who subscribe to your service because they have no choice in the matter ought to be told all the facts, just as plainly as facts can be stated.

Many people—the majority, I'm afraid—don't know that rates they pay are regulated by Corporation

Commissions or similar bodies operating under State laws. They are unaware that companies can't charge anything they like or as much as they may think the traffic will bear. As a result some customers do not know that profits are necessarily limited. Too many have been allowed to believe that utilities think of their profits first and their service to customers second. As we know, the picture has changed remarkably, but there is vast room for improvement and this is especially true of water companies.

Strange as it may seem, many companies make little or no effort to tell their stories to the people. And there undoubtedly are companies which continue to take the outmoded attitude that "they've got to have water and we're the only one they can get it from, so why bother?"

I'll try to answer that. It shouldn't be too hard.

Antipathy develops among the public every time if the utility ignores the matter of public relations or if responsible officials of a company give it only their perfunctory attention. Where the facts are withheld from him, the customer invariably is suspicious, discontented and dissatisfied. Who can blame him?

Public Ownership Problems

Too many publicly-owned utilities blithely ignore the people whom they serve. These are in the hands of officials, all too often political figures, who give no thought to the public and who feel no concern as long as the higher-ups are satisfied. They take the attitude that they are merely running another department of the government and that the people are no more interested in it than in any other department.

Sometimes they are right, but most often they are wrong. They ought to realize that they are public servants just as much as policemen or firemen. They are more than job holders, hired to run a business for the city.

It is a human trait, nurtured by long years of experience, to believe that inefficiency is inherent in government, especially municipal government. Unfortunately, in the past there has been much ground for that. So, when a government operates utilities, it isn't hard to see how suspicions of the people can be extended to cover that, too. The unfortunate development of a utility bill tax which has swept through municipal financial framework in recent years has done nothing to allay the feeling, either. Unless the people are given facts they have no way of knowing what those departments are doing except they do know when they get their bills that their money is being spent.

All right then, how can utilities obtain better public relations, especially those which are publicly owned?

It is unnecessary (and too expensive) for the average one-town utility to have a full-time public relations man. But it does need to have somebody who, in addition to being able to frame an advertisement, can convey news to the press when there is news.

I'm afraid that too many companies or municipal utility departments give the individual consumer little thought unless they need higher rates. It is too late then to cultivate good will after years of neglect. It must have been stored up in the past.

How To Present Your Facts

Every company and every city department which deals with the people directly ought to see to it that officials receive special training in the matter of contacting the public. Sometimes it is a matter of teaching good manners. But you and I know of large statewide and national businesses which make public relations a part of their training. It really pays big dividends.

Utilities officials ought to learn more about using the press—not for propaganda, of course, because that is a quick way not to get any publicity. And I don't mean turning matters over into the hands of an ex-newspaperman who has conveyed to management his own mistaken idea that he knows all about public relations. The wastebaskets of thousands of editors are filled daily with their grist. That isn't public relations—it's mimeographed tripe which never gets read.

These utilities executives ought to learn how to humanize their advertising. Cold figures are the most uninteresting things I ever saw. That's why the public hasn't become too excited at seeing in print that the national debt is now approaching $260,000,000,000. The figure is so big nobody understands it. But when you tell a man that his share of that debt and the share of his wife, each of his children and that of everyone else is $1,500 he can begin to understand. What I mean to convey is that you have to put things in ordinary everyday language to get results.

Many big business houses, manufacturing concerns and even insurance companies have learned recently to dramatize financial statements. When a company needs to get a better price for its product and can show that after paying so much for materials, so much for labor, so much in taxes and so much for depreciation, it has too small a margin of balance, the average man can understand, especially if you draw him a picture of it.

There comes to my mind right here the fine job some nationally-known companies are doing in showing how they are owned not by millionaires but by thousands of small stockholders. Nothing yet devised has been so effective in combatting the danger to free enterprise in socialistic demands for putting an unfair share of the taxation burden on corporations just because they are big and appear to the gullible to have inexhaustible resources and reserve.

News for Newspapers

As far as newspapers are concerned, any good paper is always ready to have utilities provide stories that are newsworthy. The paper can dig them out, but ought not to be forced to do so. If you have something which you think is news your consuming public would like to hear or ought to hear, give it out promptly. Don't be grudging. Don't try to hold back. If you do, a good reporter will outsmart you every time and you'll deserve the result.

I am sure that the matter of rates is the most important one of the day, for with rising costs of material, machinery, and labor, most utilities have to have additional revenue. Here, most of all, the good utility with a good sense of public relations takes the public into its confidence. It points out how much more everything is costing and how diminishing returns from present rates inevitably will result in poor service, whereas proper increases can enable it to continue to give good or even better service by having money to add new equipment and extend lines.

The private utility in most cases of this kind has to go before some State authority and prove the need. How much more effective its case if simultaneously or beforehand the utility goes to the consumer to explain by advertisement and news story.

Theoretically this necessity doesn't extend to the municipally-operated utility because it is not subject to State regulation. Here again the need for informing the consumer was never more apparent. Realize first of all that people have a right to know and are reasonable once they have the facts.

Experience in Roanoke

Let me cite an example or two in Roanoke's experience. In 1938 the City acquired the old privately-owned water company by condemnation. It was rundown and badly in need of improvements and expansion. Bonds were issued, not only for the purchase

but for immediately necessary improvements.

Then it became clear that if pressing capital outlays were to be made we must have additional revenue, which meant higher rates. When the manager of our Water Department, Charles E. Moore, presented his request to City Council, shortly after World War II, that body directed that there be sufficient delay until the people could be given a full explanation.

Normally it can be expected that taxpayers will fight any increases in levies placed upon them, even when they know public improvements are needed. So it was necessary that the water-consuming public be told everything.

The Roanoke World-News through its news and editorial columns undertook to do this job both as a duty and a privilege of serving the City and its people who are our subscribers, too. We gave them all the facts from the time the City acquired the water works. As a result, partly I hope from our efforts and partly from the wisdom of Council in handling the matter, there was not a single protest from consumers! Business and industry did kick to a certain extent because of the comparatively higher rates imposed upon them, but they went along in the end. We got the needed improvements and everyone paid his proportionate share, not cheerfully perhaps, but with realization that it was necessary. Think what would have happened had the City raised rates without explanation!

Here's another example: A little over a year ago it became apparent that a large bond issue would be necessary to purchase several small private companies in territory annexed the year before and to expand services. Once again The World-News and its morning associate, The Roanoke Times, cooperated with Council in telling the story. Result: the $4,000,000 issue passed with ease and improvements are under way as this is written.

Water and Sewage Utilities

As a result of Virginia's Water Control Act of 1946, Roanoke had to do something about sewage disposal and cleaning up the Roanoke river. Within only a few months of the water bond issue, Council and the newspapers again went before the taxpayers with the story—a $4,050,000 bond issue to be self-liquidating by charges based on water bills. Conclusion: passage with flying colors and the system rapidly nearing completion for operation in July.

A wide-awake utility, particularly a municipally-owned company, never makes a move of this kind without full preparation if it has any sense of public relations at all.

And that reminds me, if private utilities can advertise, why shouldn't cities and towns tell their story in paid advertisements? That isn't revolutionary. It's done in a good many places and, after all, it's reasonable to expect.

If you have acquired some idea that the people aren't interested in your business or your department, forget it. They're always interested in things that serve them.

How to Create Good Will

Here are just a few suggestions for getting results in cultivating that very necessary commodity: good will:

Stage periodic inspection or "open house" days for your plants and facilities. Show the people everything you think they would be interested in seeing. Guided tours are excellent when possible. Plenty of people have never seen a water plant.

Always keep your grounds and buildings beautiful. A little extra elbow grease and paint can do wonders. Keep equipment painted, shined and lettered, especially your trucks and other rolling stock.

Set up an advertising fund if you do not have one and if your company is government-owned, urge your Council to consider the necessity for advertising on occasion.

Teach every official and every employe the necessity for coutesy—it's the cheapest commodity in the world, doesn't cost a red cent and pays the biggest dividends you ever saw.

Use the news columns whenever you have something worth telling. Give out with your story.

Ask the public for suggestions. You may be surprised by the results you get. Roanoke's City Manager, Arthur Owens, conceived the idea of asking the public to drop suggestions in convenient boxes on the street or to mail them in. Many are directed at the water department and get prompt attention. The result is informed customers and usually satisfied ones.

Finally, City utilities must realize that the public is really the owner and boss. Private utilities should try to make friends of the public—not just customers, for all customers are not friends.

Remember this: goodwill is the most priceless asset a business can possess. It is even carried on the books and worth money when a sale is made. Cultivate goodwill and make it work for you.

Earle P. Johnson Is Dead

The water works industry lost a valuable friend when Earle P. Johnson, District Manager for Wallace & Tiernan in the Pittsburgh area, died May 11 at the age of 49 after an extended illness.

After graduating from Carnegie Institute in Pittsburgh in 1925, he started in the Pittsburgh office of Wallace & Tiernan. In 1930 he became District Manager, the position he held until his death. In addition to being an outstanding ambassador for Wallace & Tiernan, he was interested in water and sewage works activities in West Virginia, Western Pennsylvania and Eastern Ohio.

Six days before his death, on the occasion of the Awards Presentations at the Annual Meeting of the American Water Works Association in Kansas City, Earle Johnson was presented in absentia the George Warren Fuller Award from the Pennsylvania Section.

The citation read: "For the genial, tactful and devoted service which he has rendered the water works profession, and his untiring effort on behalf of the Association in his many years of service as Secretary-Treasurer of the Western Pennsylvania Section."

Milwaukee's New Sewage Problem

If it isn't one thing in sewage treatment, its another—or, at least so it seems at Milwaukee.

The latest problem is the rising level of Lake Michigan. With only 6 inches of free-board between the level of the final settling tanks and the lake level at present, engineers are predicting the highest lake level in a century is yet to come in 1952.

Milwaukee is faced with the problem of what to plan on, the expensive installation of emergency pumps to the extent of 200 mgd, capacity, or a possible sand-bagging of the tanks.

Heavy lies the head that wears the sewage treatment crown!

The Senior Author

Remodeled Trickling Filters
Exceed Expectations at Baltimore

Performance Record of 40-Year-Old Slow Rate Filters Since Conversion to High Rate Units.

by C. E. KEEFER* *and* JOSEPH MEISEL†.
Bureau of Sewers, Baltimore, Maryland.

DURING 1938-1939 large scale experiments were conducted at the Back River sewage-treatment works[1], serving the City of Baltimore, to determine the performance of existing trickling filters when converted to receive high rates of flow. As a result of these experiments the entire 30 acres of rectangular filters, which is the largest installation in the United States, were equipped with rotary distributors[2]. Since the conversion tests indicate that filter performance is equal to, in fact better than, that obtained during the preliminary experiments.

* Deputy Chief Sewerage Engineer.
† Senior Chemist, Back River Treatment Works.

Preliminary Experiments

The preliminary experiments extended over a period of one year. Settled sewage was applied to the filters at rates varying from 6.5 to 30.0 million gallons per acre daily by means of two 8-arm rotary distributors, each being 47 ft. 6 in. in diameter. The filters, which have been in service for many years, are constructed of trap rock varying in size from 1 to 2½ in. and are 8½ ft. deep. With rates of application varying from 6.5 to 14.0 mil. gal. per acre per day 5-day B.O.D. reductions from 79 to 90 per cent were obtained in summer and from 71 to 73 per cent in winter. When the dosage was 26 mil. gal. per acre per day, the B.O.D. removal approximated 50 per cent in winter and 73 per cent in summer. The results indicated that the capacity of these filters, which had been treating sewage at a rate of about 3⅓ mil. gal. per acre per day, could be increased considerably without detrimentally affecting their performance or the quality of effluent.

Remodeling Trickling Filters

Plans were therefore prepared to provide the filters with facilities for increasing the dosing rate. They were equipped with 50-rotary distributors, each 157 ft. 6 in. in diameter, at a

CONVERTED 40-year-old trickling filters of Baltimore, now equipped with Dorrco Distributors for high-rate operation. (With an area of 30 acres is America's largest trickling filter installation.)

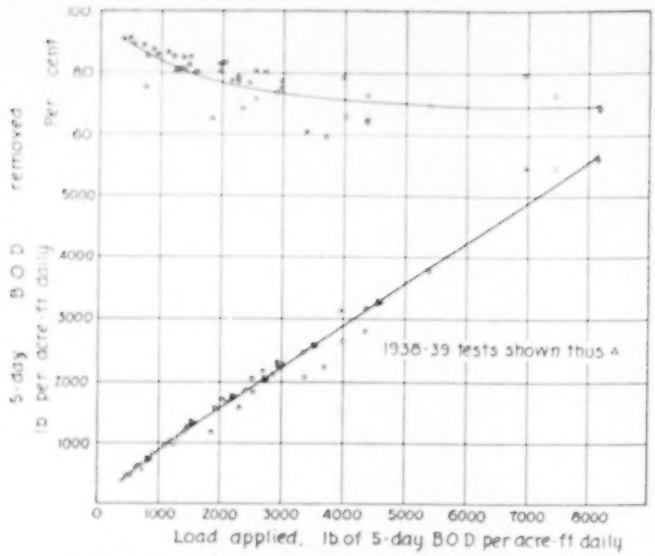


Fig. 1—Relationship between B.O.D. applied and that removed by high-rate trickling filters.

cost of $680,186. The capacity of 49 of these can be varied from 1.34 to 2.64 m.g.d. per distributor, and the capacity of the other distributor, which is a test unit, can be varied from about 2.5 to 16.0 mil. gal. per acre daily. A manhole was built in the filter stone adjacent to the test unit for collecting samples of effluent at different depths to determine the effect of bed depth on filter performance. Each distributor was erected on a 4.5 x 4.5-ft. concrete foundation, built up from the bottom of the filters. The 50 distributors are served by 5 cast-iron pipe lines, that vary in diameter from 16 to 36 in. and connect with the settled sewage channel.

Checking Performance of Remodeled Filters

In order to check the original experiments, tests were conducted from September 26 to October 26, 1951, with dosages varying from 2.68 to 16.39 mil. gal. per acre per day and temperatures ranging from 69 to 75°F. Rates of dosage were determined by measuring the volume of influent caught in shallow pans, set on the surface of the filter stone. Each predetermined rate of flow was maintained continuously for 8 hr. During each of these periods samples of influent to the filter and effluent from the 4 sampling ports in the filter, which were 2, 3.75, 5.5 and 7.25 ft. below the surface of the stone, were collected hourly and composited over the 8-hr. period. The results are given in Table I and are shown in Figs. 1, 2 and 3. Fig. 1 indicates the relationship between the 5-day B.O.D. applied to and that removed by the filter. The loadings and the removals corresponding to all four depths of stone for all the rates of flow are shown. High loadings in general occurred when high rates of flow were applied to a minimum depth of stone. With dosages varying from 2.68 to 16.39 mil. gal. per acre daily the 5-day B.O.D. removal ranged from 77.3 to 91.1 per cent when the sewage passed through 7.25 ft. of stone and from 60.8 to 84.5 per cent when the sewage passed through just the first 2.0 ft. of stone. As indicated in Fig. 1 there is practically no difference in the B.O.D. removals during the 1938-39 preliminary experiments and the recent tests made in 1951. Results obtained during the colder months of 1938-39 are not shown in Fig. 1, as there was necessarily at such times a reduction in performance.

Fig. 1 also indicates the relationship between the B.O.D. load and the percentage removal of B.O.D. There was a dropping off in the percentage of removal as the load increased. With a 5-day B.O.D. load of 500 lb. per acre-foot per day an average removal of about 90 per cent was obtained, and with a load of 8,000 lb. the removal was approximately 69 per cent. When the filter effluents were settled quiescently in the laboratory for 2 hours, the additional B.O.D. removal varied from 6.1 to 32.8 per cent and averaged 13.4 per cent.

Fig. 2 gives the relationship between the liquid load applied, expressed in million gallons per acre daily, and the 5-day B.O.D. of the effluent for the tests made in 1938-39 and in 1951. The character of the effluent, as judged by the B.O.D., was comparable during these two periods when the rate of sewage application was approximately 6.5 mil. gal. per acre per day or less. However, at higher rates the effluent had a lower B.O.D. during the 1951 tests than had been indicated in the experimental trials of 1938. Fig. 2 also shows the

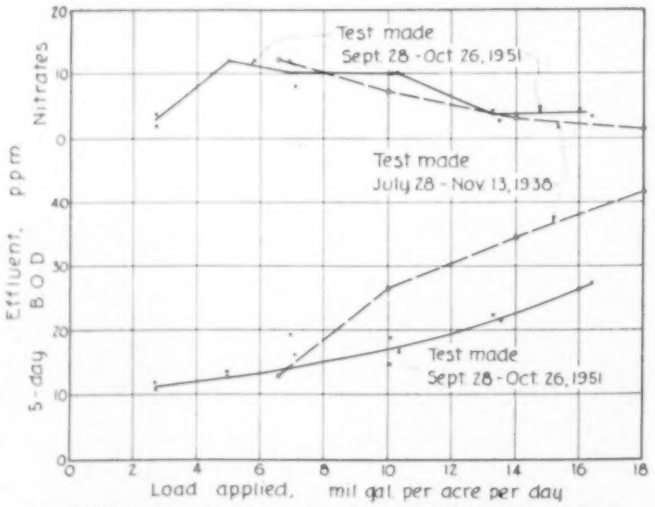


Fig. 2—Relationship between rates of sewage applied, and quality of effluent. (Note unexpected superior performance of actual installation over test installation of 1938.)

nitrate content in the effluent during the two test periods. In each instance there was, as to be expected, a reduction in nitrification with higher dosages.

Fig. 3 gives the 5-day B.O.D. removed by various depths of filter stone when the rate of application was approximately 10 mil. gal. per acre per day for the 1939 and the 1951 tests. Removals were appreciably higher in 1951 than in 1939.

Conclusions

The tests made in 1951 indicate the following:

1. Throughout the temperature range of 69 to 75 F. the B.O.D. removals with loadings varying from 2.68 to 16.39 mil. gal. per acre per day (375 to 8175 lb. of 5-day B.O.D. per acre-foot per day) were practically identical during the 1938-39 and the 1951 tests.

2. B.O.D. removals in excess of 80 per cent were obtained during the 1951 tests with loadings ranging from 2.68 to 13.53 mil. gal. per acre daily.

3. Providing equipment for increasing the load on the filters has been amply warranted.

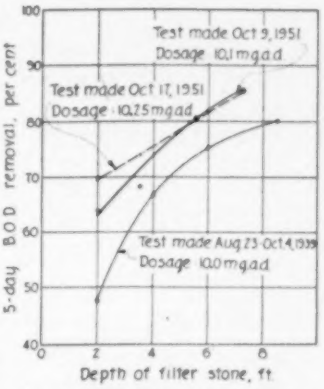


Fig. 3—B.O.D. removal by high-rate filters at various depths. (Note high removal in upper two feet of bed.)

It should be emphasized that all the tests were made when the temperature of the sewage was above the yearly average. During the winter months removals at high rates would undoubtedly be less.

Acknowledgments

The Back River sewage treatment works are under the general direction of P. L. Holland, Director, Department of Public Works, with John J. Hunt, Sewerage Engineer. Dr. Abel Wolman is consultant to the Department of Public Works. R. J. Trautman, Principal Associate Engineer, has direct supervision of the sewage works and Paul L. Smith is plant superintendent.

References

1. Keefer, C. E. and Kratz, Jr., Herman, "Experiments with High-Rate Trickling Filters at Baltimore." *Sewage Works Jour.* 12, 3, 477 (May, 1940).
2. Keefer, C. E., "Mechanical-Equipment Installations Add 40 Per Cent to Sewage Plant Capacity, Back River Sewage Works." *Eng. News-Rec.* 143, 32 (Oct. 20, 1949).

Table I.
PERFORMANCE OF HIGH-RATE FILTER, BACK RIVER SEWAGE WORKS, BALTIMORE, MD.

	FILTER INFLUENT			LOAD APPLIED		FILTER EFFLUENT							
						Not Settled					Settled for 2 Hrs.		Depth below top of filter where sample taken ft.
									5-da. B.O.D. Removal				
Date 1951	5-day B.O.D. p.p.m.	Susp. Solids p.p.m.	Temp. °F.	Mil. Gals. per Acre Daily	Lbs. 5-day B.O.D. per Acre-ft.	5-day B.O.D. p.p.m.	Susp. Solids p.p.m.	NO_2 N. p.p.m.	%	Lbs. per Acre-ft. Daily	5-day B.O.D. p.p.m.	5-day B.O.D. Removal, %	
9/28	121.6	111	75	2.68	1355	18.9	22	1.2	84.5	1140	15.4	18.5	2.0
					725	29.9	21	1.2	75.4	545	23.9	20.1	3.75
					494	10.1	4	1.6	91.8	464	9.1	9.8	5.5
					375	10.9	10	2.0	91.1	341	9.4	13.8	7.25
10/5	129.6	104	75	2.68	1445	23.2	18	1.2	82.2	1180	20.0	13.8	2.0
					771	19.2	8	1.0	85.4	655	17.7	7.8	3.75
					526	13.6	0	4.0	89.6	469	12.1	11.0	5.5
					400	11.9	0	4.0	90.8	363	10.9	8.4	7.25
10/19	118.0	113	72	4.97	2435	27.7	13	3.4	76.5	1870	24.7	10.8	2.0
					1300	22.1	13	3.4	81.3	1060	20.1	9.1	3.75
					885	14.1	0	12.0	87.9	780	13.1	7.1	5.5
					675	12.9	0	12.0	89.2	600	10.9	15.4	7.25
10/26	122.4	125	70	4.98	2540	34.9	13	3.0	71.5	1820	31.9	8.6	2.0
					1356	23.0	5	4.0	81.1	1105	21.0	8.7	3.75
					925	17.1	4	10.0	86.0	794	15.5	9.4	5.5
					700	13.3	2	12.0	89.2	625	12.3	7.5	7.25
10/18	138.4	156	72	6.93	4000	47.0	23	2.0	66.0	2635	39.9	15.1	2.0
					2138	31.1	8	3.0	77.5	1656	28.1	10.7	3.75
					1453	25.9	1	8.0	82.0	1190	21.0	16.0	5.5
					1100	19.1	0	12.0	86.3	950	17.1	10.5	7.25
10/10	115.2	252	69	7.05	3390	45.0	35	3.0	60.8	2065	38.0	15.6	2.0
					1808	40.1	25	3.6	65.2	1180	35.1	12.5	3.75
					1232	22.3	18	8.0	80.5	990	16.3	26.9	5.5
					932	16.0	21	8.0	86.0	805	14.0	12.5	7.25
10/9	103.2	130	70	10.10	4350	37.2	23	4.0	64.0	2770	35.2	5.4	2.0
					2320	32.7	27	6.0	68.3	1580	30.7	6.1	3.75
					1580	19.8	12	10.0	80.6	1270	17.8	10.1	5.5
					1200	14.6	7	10.0	85.8	1030	12.6	13.7	7.25
10/17	126.4	246	70	10.25	5400	37.9	15	4.0	69.9	3780	34.9	7.9	2.0
					2886	32.8	10	4.4	74.0	2136	30.8	6.1	3.75
					1960	24.6	0	10.0	80.3	1565	22.6	8.1	5.5
					1490	18.5	7	10.0	85.3	1270	16.5	10.8	7.25
10/4	134.4	118	75	13.27	7425	36.2	24	1.6	73.1	5450	30.2*	16.6	2.0
					3960	28.6	11	1.2	78.6	3120	24.6	14.0	3.75
					2700	26.5	0	4.0	80.2	2170	20.5	22.6	5.5
					2050	22.1	0	4.0	83.6	1715	17.1	22.6	7.25
10/27	122.8	89	72	13.53	6925	25.5	12	1.2	79.2	5485	21.5	15.7	2.0
					3700	49.6	21	1.2	59.6	2210	42.0	15.3	3.75
					2520	23.7	1	2.0	80.7	2040	21.7	8.4	5.5
					1905	21.3	6	2.8	82.7	1581	19.3	9.4	7.25
10/3	122.4	115	75	16.0	8175	38.6	25	3.2	68.4	5600	32.6	15.6	2.0
					4370	31.1	13	3.2	72.9	3180	28.1	15.1	3.75
					2970	27.4	17	4.4	77.6	2300	18.4	32.8	5.5
					2250	26.1	4	4.4	78.6	1770	20.1	23.0	7.25
9/26	119.6	276	75	16.39	8150	36.4	20	1.2	69.6	5680	29.4	19.3	2.0
					4360	42.2	31	2.4	64.7	2820	34.2	19.0	3.75
					2970	29.6	30	3.0	75.3	2240	25.6	13.5	5.5
					2250	27.2	61	3.4	77.3	1740	23.2	14.7	7.25

High-Rate Trickling Filters In New England States*

by FRANK L. FLOOD, *Partner, Metcalf & Eddy, Engrs., Boston, Mass.*

THERE are two principal subdivisions of sewage treatment, primary and secondary. Primary treatment is normally accomplished by sedimentation and results in 35 to 60 per cent reduction of polluting material. Secondary treatment may be accomplished in a number of ways including the use of chemical precipitation, stone filters, the activated sludge process or sand filters. Overall plant efficiency in reduction of pollution by secondary treatment may vary from 75 per cent, in the case of chemical treatment, to 98 per cent or more, for sand filters.

Chemical treatment, because of its relatively low degree of removal and high operating cost, does not have wide application and is not used to any considerable extent in New England.

The standard activated sludge process produces a high degree of removal in a comparatively small area and is most applicable where such degree of treatment is required in large cities or in small communities where the area is restricted in size and poorly isolated. The only activated sludge plants in New England are located at Leominster, Mass., Milford and New Canaan, Conn., and Cranston, Providence, and Woonsocket, R.I.

There are at present 6 municipal sand filter plants in Connecticut and 28 in Massachusetts. The loading on a sand filter should normally not exceed 75,000 gad. (gal. per acre per day). As the filters become clogged this rate may be reduced to 50,000 gad. or less. For a population served of 20,000 and a sewage flow of 2 mgd. (million gal. per day), a total area of 30 to 40 acres of sand filters may be required. Owing to the large area required per capita served and the cost of operation, this method is adopted now only for institutions or by small municipalities where conditions are favorable.

In the early 1900's it was found that sewage could be distributed over the surface of stone beds 6 to 10 ft. deep at rates of 2 to 3 mgd. per acre and that a reasonably stable effluent could be obtained. The effluent was not as highly nitrified as from the sand filters and was not as clear. However, the degree of treatment afforded was found to be satisfactory for all except the most exacting situations.

By comparison with sand filters the standard stone or trickling filters offered several advantages. For a population served of 20,000 and a sewage flow of 2 mgd., a total area of less than 1 acre is required as compared with 30 to 40 acres of sand beds. Together with the smaller area occupied by filters, the stone filter required less upkeep and can successfully treat a greater range of flow than the sand beds.

The operation of standard rate stone filters is frequently attended by the production of great numbers of small moth flies. Ordinarily these flies do not stray far from the filters but under favorable wind conditions the flies may cause a nuisance 1,000 ft. or more from the plant. Standard rate stone filters sometimes become clogged in the top few inches of stone. This clogging has been broken up by harrowing, by application of chlorine and by washing down with a stiff hose stream.

High-Rate Trickling Filters

The high-rate trickling filter has been defined* as a trickling filter operating at an average daily dosage rate usually between 10 mgd. and 30 mgd. per acre, sometimes including recirculation of effluent. The normal loadings are expressed in terms of sewage flow excluding recirculated sewage. The total rate of application to the filter, including recirculated flow, is important in considering the capacity of the distributor and of the sedimentation tanks which must handle the recirculated flow.

The B.O.D. loading on standard rate trickling filters is, in general, not more than about 500 to 600 lb. of applied B.O.D. in the sewage per acre-foot of filter stone. The B.O.D. loading on high-rate filters is usually considerably in excess of 1,000 lb. of applied B.O.D. in the sewage and ex-

*Glossary - Water and Sewage Control Engineering, Joint Comm., APHA, AWAA, ASCE, FSWA (1949).

BRISTOL, CONN., Sewage Treatment Plant Improvements.
Foreground—Grit chambers, Parshall flume and Comminutors.
Rear (right to left)—Preliminary settling tanks, high-rate filters, fixed roof primary digester, float gasometer secondary digester, final settling tanks and effluent recirculating station, with chlorination building on extreme left.

*Presented at the fall meeting of the New England Sewage Works Association, Nov. 6, 1951, and released for publication in Water and Sewage Works.

COMPACTNESS of the Bristol, Conn., Plant Revealed in This Air View.
Note extent of the obsolete intermittent sand filters replaced by two modern high-rate filters. In lower left can be seen sand filters which have been converted to sludge drying beds.

clusive of any B.O.D. in the recirculated liquor per day per acre-foot of filter stone. A common loading on high-rate trickling filters for normal municipal sewage is in the vicinity of 2,500 lb. of B.O.D. in the applied sewage per acre-foot per day.

Frequently the unit B.O.D. loading on the filters is expressed in pounds per cubic yard of filter media. The conversion of pounds per cubic yard to pounds per acre-foot is a simple arithmetical problem of multiplying by 43,560 (cubic feet per acre-foot) and dividing by 27 (cubic feet per cubic yard). The resultant multiplier is 1,613. A rating in pounds per acre-foot divided by 1,613 would give the loading in pounds per cubic yard.

The recirculation and dilution features of the high-rate filter probably were used as early as 1904 by Dr. Fowler at Manchester, England, and a little later at Bradford, England, in the treatment of gas liquors.

The earliest installation of a high-rate filter on a plant scale was at the Camarillo State Hospital in California. The design of this plant was based upon the results of experiments of Mr. H. N. Jenks. Mr. Jenks reported the results of his experimental studies on high-rate filters in 1936*.

*Sewage Works Jour. Vol. VIII, Pg. 401, May 1936.

High-Rate Filter at Army Posts

There were ninety sewage treatment plants built at Army posts during World War II where high-rate filters of various types were provided. Fortunately sufficient data were obtained from the operation of these high-rate filters at Army posts to demonstrate to a considerable degree what could be accomplished by this new development in a relatively old process in the treatment of what might be considered as relatively concentrated domestic sewage.

The available data on operating results at these plants has been assembled, correlated, and analyzed by the Subcommittee on Sewage Treatment of the National Research Council.* Subsequently this report was carefully reviewed and the summary and conclusions were published.**

Municipal High-Rate Filters

An inventory of sewage treatment plants in the U. S. by the U. S. Public Health Service in 1942 showed ninety municipal high-rate filter installations. A similar inventory in 1945 indicated that there were 122 municipal plants using high-rate filters and serving a population of 711,455. Since the post-war construction of sewage treatment plants had hardly commenced in 1945, it is probable that the number of plants employing the high-rate process has increased greatly in the six years that have elapsed since that time.

A summary of basis of design for high-rate filters recommended by Metcalf & Eddy for five municipalities in New England is given in Table 1. These data are all based upon the use of single-stage filters with 6 ft. depth of stone.

Table 1
BASIS OF DESIGN
High Rate Filters in New England
by Metcalf & Eddy

Plant	Average sewage flow to filter, mgad.	Average 5-day B.O.D. load lb. per-acre-foot per day
Bristol, Conn.	11.5	2,580
Marlborough, Mass.	9.4	2,500
Hopedale, Mass.	9.1	1,950
Gardner, Mass.	8.9	2,130
Rockville, Conn.	14.3	1,660

High-Rate Filters in Massachusetts

The operating results of five high-rate filter plants in Massachusetts for 1950 and 1951 to date, based on the analysis of the State Department of Public Health, are given in Table 2. Presumably, samples were composited by the plant operators to represent the

*Sewage Works Jour., Vol. XVIII, Pg. 791, Sept. 1946.
**Sewage Works Jour., XX, Jan. 1948.

MARLBOROUGH, MASS., High-Rate Filter Installation.
These units treat effluent from Imhoff tanks shown in background.

normal daytime flow. How representative the individual samples are depends, therefore, upon the skill and care of the individual plant operators. Apparently the high-rate filter plants in Massachusetts effect a removal or reduction of about 85 per cent of the suspended solids and 5-day B.O.D.

Advantages of High-Rate Filters

The effluent from standard trickling filters may be highly nitrified and promote an undesirable growth of vegetation in the receiving streams. High-rate filters may be designed and operated so as to produce a final effluent low in or devoid of nitrates; the effluent may, however, have a reasonably low B.O.D. and be low in suspended solids. Such effluent is, in some circumstances, preferable for discharge into streams as compared with the effluent from standard rate filters.

Where the removal of 85 per cent suspended solids and B.O.D. on the average is satisfactory, the high rate trickling filters should be more economical than the standard rate filters.

The filter fly problem is usually much less serious in the operation of high-rate filters than is the case with standard filters because of the high rate of dosing and practically continuous wetting, the smaller area involved, and the relative ease with which the area can be covered with D.D.T. or other insecticides.

High-rate filters are in competition with high-rate activated sludge plants on new installations for all but the very large plants. Since each project has its particular conditions and requirements, it may be unwise to generalize. However, in the author's opinion, where the high rate filter is suited to the conditions, it is usually the preferable treatment process because:

1. It is simpler to operate.
2. It is less subject to process upsets.
3. Operating costs are usually lower.

The possibility of dissemination of odors from the filter or the creating of objectionable conditions of filter flies, has retarded the use of high-rate filters where the plant site does not have some degree of isolation from built-up areas. As experience is gained from the operation of the filters and

Table II
OPERATING RESULTS
High-Rate Trickling Filter Plants
Massachusetts, 1950-1951
Analyses by Mass. Dept. of Public Health

Plant		Suspended Solids				5-Day B.O.D.			
		Raw ppm.	Settled ppm.	Final ppm.	Over-all removal %	Raw ppm.	Settled ppm.	Final ppm.	Over-all removal %
Worcester									
(8)	1950	192	126	47	88	127	127	23	87
(5)	1951	306	117	51	83	143	108	15	90
Gardner									
(8)	1950	232	96	38	88	571	188	68	88
(3)	1951	252	107	61	74	253	147	69	73
Marlborough									
(4)	1950	207	54	29	86	245	82	55	78
(5)	1951	239	66	30	87	290	149	42	86
Hopedale									
(3)	1950	145	45	20	86	208	87	20	90
(3)	1951	153	66	22	86	220	113	26	88
Northbridge									
(4)	1950	212	79	32	85	248	169	75	70
(3)	1951	181	83	26	86	175	120	25	86
Numerical average					85				84

in the control of odors and flies, it is possible that isolation will become less of a factor in the choice between these two high-rate processes.

Rotary Distributors

The development of high-rate filters was coincident with a marked change in the method of dosing and distribution of the sewage onto the filters. Only a small proportion of the standard trickling filters constructed prior to 1936 had been equipped with revolving distributors, whereas practically all of the high rate filters are so equipped. The successful operation of the revolving distributors on standard trickling filters at Pontiac, Michigan, for many years prior to 1936 led the way for their general adoption even in cold climates.

Four-armed distributors are commonly used, with two of the four arms equipped with weir boxes or siphonic overflows so as to provide satisfactory operation of the mechanism under a considerable range of flow between minimum and maximum.

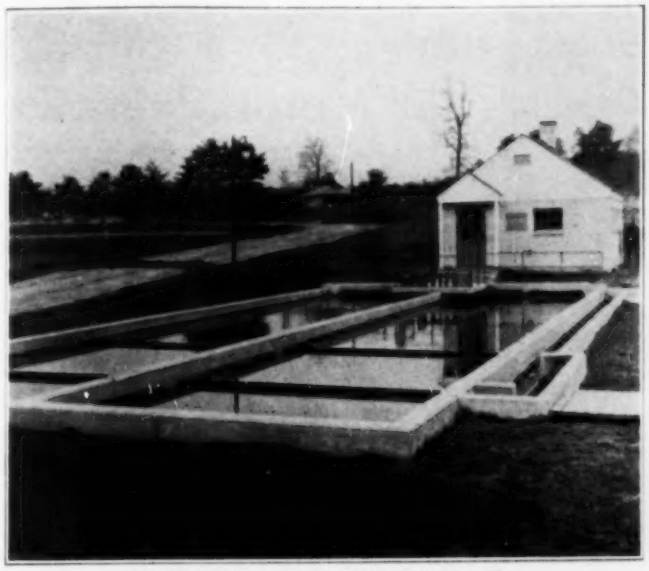
Filter Stone

It is important for good high-rate filter operation to provide stone of suitable characteristics and to place it in the filter in a proper manner. Our specifications for filter stone normally require that:

"The stone shall be trap rock and shall be sound, hard, tough, and durable stone. The rock shall be thoroughly screened, uniform in size and quality, angular, and no flat or elongated or otherwise objectionable stone shall be used. The rock shall conform in size to the following requirements:

Size of square sieve	Percent passing
3½ in.	at least 95
2½ in.	not over 15
1¼ in.	not over 5

The stone may be tested in accordance with the Tentative Method of Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate, ASTM Designation C88-39T and must pass 10 cycles of this test to be acceptable.



RECIRCULATION Pump House, Marlborough, Mass., Plant. The final settling tanks are shown in foreground.

"Stone for the filter media shall be taken only from a pit or quarry approved by the Engineer. All the filter stone shall be taken from that part of the pit or quarry containing the most satisfactory stone. Quarrying shall be conducted so as to prevent the mixing of clay or earth overburden with the material.

"The crushing and screening of the stone shall be carefully controlled so as to produce stone meeting the specifications as to size. It is particularly important that the screening process remove effectively material smaller than the lower limit specified within the allowed tolerance. It is of critical importance that the material shall be clean and free from screenings, dust, fine stone, dirt or other foreign substances. The screened stone shall be washed or air-blasted as required to obtain material of reasonable cleanness."

Characteristics of High-Rate Filters

Most of the high-rate trickling filter installations in New England are single-stage filters with 6-ft. depth of stone. In most cases recirculation is provided for the effluent of the filters back to the influent of the preliminary sedimentation tanks. Other methods of operation of the high-rate filters are available including two-stage filters and a variety of choices as to the method of recirculation. The subject of high-rate filter design has been thoroughly covered by Greeley*.

Summary

High-rate trickling filters have become established in New England as a practical and economical means of secondary treatment for sewage. It is probable that this process will be used to an increasing extent at new plants and to replace or to supplement existing intermittent sand filters.

*Sewage Works Jour., Vol. XX, Sept. 1948.

Bibliography on Air Pollution

The Manufacturing Chemists' Association, Inc., Washington, D.C., has announced that an extensive bibliography on air pollution, covering causes, effects, control and abatement methods has been published as Chapter 12 of the MCA Air Pollution Abatement Manual.

More than 1500 references in the literature that have appeared on the subject up to January 1, 1952, form the present compilation by George F. Jenkins, of the Engineering Department of Carbide and Carbon Chemicals Co.

Literature is listed under six principal headings: Biological, Legislative, Technical, Standards, Education and Miscellaneous. Seven other bibliographies were consulted in assembling the present chapter, in order to supplement the author's search, although not all of the entries were used. Material that did not refer specifically to air pollution has been excluded.

The author notes in the preface that the card file from which the bibliography was assembled will be kept up to date and requests that errors and omissions noticed by readers be reported to the Association. Supplements, which will be published every six months, will contain corrections and new references.

Orders for Chapter 12 and correspondence about the bibliography should be addressed to the Manufacturing Chemists' Association, Inc., Woodward Building, 15th and H Streets, Washington 5, D.C. Remittance of 50 cents for each copy of the chapter should accompany orders.

Sludge Gas as Fuel for Motor Vehicles

Experience, Technique and Economy of this Application in Germany

by Dr. KARL IMHOFF, *Essen, Germany*
Translated by C. E. KEEFER*, *Editorial Associate*

SHORTLY after World War I, sludge gas was extensively utilized from municipal sewage-treatment plants in Germany[1, 2]. Since 1923 the Ruhr District has sold to the municipal gas works in Essen the gas from the Essen-Rellinghausen sewage-treatment works, which serves a population of 50,000. The gas from this plant has been used since 1927 to heat the sludge-digestion tank[3]. Since 1929 the Ruhr District, first at the Iserlohn activated-sludge plant serving 20,000 people and then at the Essen-Rellinghausen activated-sludge plant[4, 5], produced all the power needed at the plants by means of gas engines using sludge gas as fuel and utilized the water which was required to cool the engines to heat the digestion tanks.

Before World War II the interest of German sanitary engineers was directed more towards the agricultural utilization of sewage[6]. At the same time plants for compressing sludge gas were built in many cities for the purpose of carrying the gas in steel containers in motor vehicles and using it as a substitute for gasoline. Among these cities were Stuttgart, Munich, Halle, Berlin and Essen.

These plants proved to be very satisfactory during the war, when there was a shortage of gasoline. After the war there was an effort to increase further the production of sludge gas in digesters by the introduction of solid waste materials[7]. As building actively began again, still larger gas compression plants were built at the existing sewage-treatment plants in Dusseldorf, Hagen, Wuppertal and by the Niers District in Neersen.

Model Compression Plant

The newest plant of this kind was erected by the Wupper District in Wuppertal. In what follows this plant is described as a model[8]. In all the remaining German cities the technique of the plant is the same. The engines have been supplied mostly by the Esslingen machine factory.

The Wuppertal sewage-treatment works is operated by the Wupper District. The Wupper District has furnished the accompanying photographs, Figs. 1 and 2. The sewage-treatment plant consists of settling tanks and sludge digesters. The primary digester is covered and heated to 86°F. Heating can be accomplished either with coke or sludge gas. If heating is with sludge gas only, about a third of the volume of crude gas is needed for the purpose. The secondary digesters are open tanks with earth banks. The plant serves 280,000 persons. Industry contributes only a little organic material.

The sludge gas consists of 65 per cent methane and 35 per cent carbon dioxide. The volume amounts to 211,900 cu. ft. daily (temperature 86°F.) or 0.73 cu. ft. per capita per day. The gas is stored in a gas holder with a capacity of 106,000 cu. ft. (Fig. 1). Both compressors, the wash tower and the 16 containers for the compressed gas are in the engine building.

Both compressors (Fig. 2) are five-stage. They have a capacity of 212 cu. ft. per minute, requiring 120 h.p. and compressing the gas to 350 atmospheres. One machine operates 16 hr. a day, generally at night, because the cost of electric power is cheaper then.

Between the second and third stage of compression at a pressure of 20 atmospheres the gas is directed through a spray wash tower, countercurrent to water under pressure. Thus the carbon dioxide is washed out, and at the same time the quantity of hydrogen sulfide is reduced. The quantity of washwater needed is 101 gal. per min., or 6 per cent of the volume of untreated gas. In addition 22 gal. per min. of cooling water is needed for the compressor.

The washed methane still contains 5 per cent carbon dioxide. The amount as saleable gas amounts to about 1,000 cu. ft. per 1,700 cu. ft. of untreated gas. The power needed to compress and wash the gas is 16.1 kw-hr. per 1,000 cu. ft. of washed methane. With electric power costing 0.09 German marks* ($0.021) per kilowatt hour the cost of power needed to produce 1,000 cu. ft. of washed gas is 1.4 German marks ($0.33), and the entire cost is 2.8 German marks ($0.66).

*1 German mark = $0.236 at present rate of exchange.

Fig. 1—Gasholder and Machine Building for Compressing Methane Gas.

*Deputy Sewerage Engineer, Bureau of Sewers, Baltimore, Md.

Cost Considerations

From 211,900 cu. ft. of untreated gas daily 124,600 cu. ft. of saleable methane can be obtained each day, or 45,500,000 cu. ft. per year. If 35,-310,000 cu. ft. of this is sold yearly, the annual operating cost is 100,000 German marks ($23,600). The present-day sale price of 1,000 cu. ft. of washed methane is 9.06 German marks ($2.14). The revenue from the yearly sale of 35,310,000 cu. ft. of methane is 320,000 German marks ($75,500). The yearly surplus is 220,000 German marks ($51,920). The construction cost of the gas holder and the plant for compressing, washing and selling the gas has amounted to 550,000 German marks ($129,800). Therefore the cost of construction can be written off in three years from the operating balance.

The calculation indicates that employing sludge gas for operating motor vehicles at German sewage-treatment works is very economical. This condition pertains particularly to cities with populations greater than about 40,000.

The only question is whether methane gas will, in the long run, find a good market. When compared with gasoline the only disadvantage is the great weight of the containers, which must be carried along by the vehicle. A normal steel container weighs 172 lbs. when empty. It is 5 ft. 8 in. long and has an outside diameter of 9 in. The gas pressure is 200 atmospheres. At this pressure the container holds 424 cu. ft. of methane. This quantity of gas will develop a mileage corresponding to that resulting from the use of only 3.6 gal. of gasoline. When using methane, the weight of the container required to generate 1,000 B.t.u. amounts to 0.48 lb. In the case of gasoline, however, a weight of only 0.07 lb. is required.

On account of the heavy containers methane is used only in trucks. But in trucks, engines driven by gasoline or gas are being superseeded more and more by Diesel engines driven by heavy oil. It is only the old trucks that tank up at gas tanks. If the development continues, it is feared that the number of trucks driven by gas motors will gradually become less.

Still in the industrial district of the Ruhr today 7,800 vehicles use methane. Among the furnishers of methane the municipal sewage-treatment works are only a small minority. Methane is also obtained for operating vehicles from natural gas and at nitrogen-synthesis plants. One assumes that the methane market for motor vehicles can continue perhaps for ten years. Later another use for sludge gas from municipal sewage-treatment works must be sought.

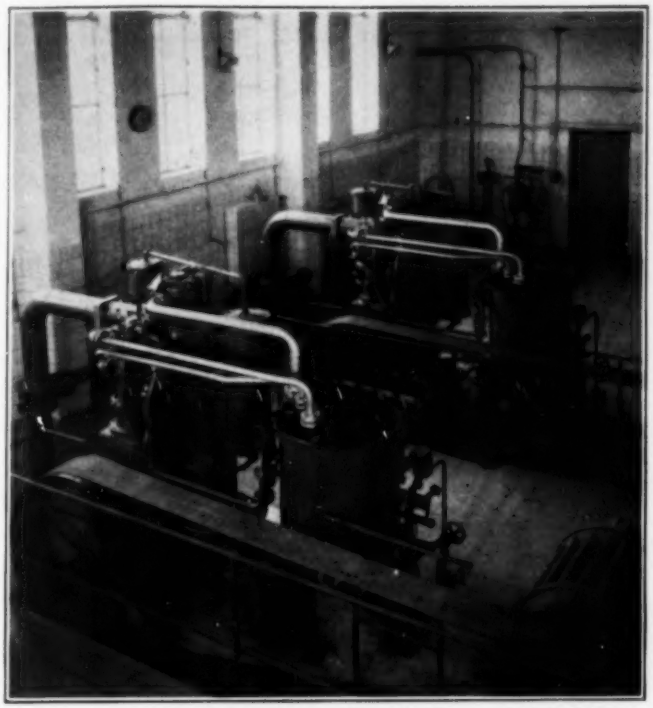


Fig. 2—Interior of Machine Building showing 5-Stage Compressors and Electric Motor.

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Water With a Southern Accent!

Well we've heard many descriptions of water, but never heard of a "water with a southern accent" until reading about it in a well known distiller's add in Barron's Financial Weekly. Here's what the ad had to say about the fine water going into XYZ's whiskies.

"Chances are, the pioneer who discovered it didn't realize that he had found the best-tasting water in America. Or that this water would play a great role in making whiskey.

But the pure, clear spring water of Kentucky and southern Indiana is now famous for the fine flavor it lends to whiskey during distilling.

You'll find many XYZ distilleries in the regions where this water with a "southern accent" flows cold and clear. In fact, ever since XYZ began making whiskey, it has located its distilleries near pure, deep, delicious springs."

Business Survival and Water Supply

"A shortage of water for industrial purposes can, just as surely as a shortage of manpower, materials or capital, defeat our hopes for future growth and prosperity—yes, even imperil our national safety.

"No business or industry can long survive when water is inadequate as to quantity or quality."

—Natl. Assn. of Mfrs. report, "Water in Industry."

Asbestos Paper Wastes Treatment

Results of pilot plant studies at Norristown, Pa., lead to selection of high rate clarification

by R. W. SIMPSON*, E. T. DUKE**, *and* K. THOMPSON***

IN accordance with the Commonwealth of Pennsylvania Clean Streams Program, many paper mills located within the State have been ordered to reduce wastes discharged from process operations. Generally the treatment of process water, especially white water, has not proven too difficult and has resulted in fiber recovery and water conservation.

Many investigations of paper mill waste problems have demonstrated each plant to be "individual" in nature, requiring separate study prior to design of a waste treatment system. Variations in finished product make each mill a particular and distinct problem.

Norristown Magnesia and Asbestos Co., located in Norristown, Pa., was faced with installation of a waste treatment plant to reduce the load of suspended solids and B.O.D. discharged to the Schuylkill River. Prior to design of a treatment plant, extensive laboratory scale and pilot plant studies were made to determine the most economical and efficient system for installation. It was decided that the aim in treatment should include the required reduction in stream pollution, recovery of fiber and production of sludge usable in the mill, clarification of water for reuse in process operation, and reduction of heat losses.

Source of Waste

The manufacture of asbestos paper, insulating paper and asbestos millboard are operations which produce fluid wastes. Two machines of the cylinder type are used in making asbestos and insulating papers and one machine for making millboard. The resulting wastes may be classified as "white waters." A portion of the white water is recycled for making up the stock in the beaters and for use in the rough sprays and deckels. The excess white water is bled off to waste discharge. The excess of fluids in the system originates mainly from clear water additions to the shower heads.

Raw materials employed in the manufacturing processes include the following: asbestos fibers, unbleached sulfite screenings, bleached sulfite, pulversized limestone, starch, mixed paper, sodium silicate, hydrated lime, cattle hair, and caustic soda. Dissolved or suspended portions of the raw materials form the solids content of the white water.

Volume of Waste

Flow measurements were first made to determine the volume of waste discharged. A weir was installed in the discharge line from the plant, Fig. 1. Flow measurements were made every 30 minutes over an eight hour operating period. Flow data, calculated as discharge per ton of product, are shown in Table I.

At the time flow measurements were made, samples of raw waste were obtained and analyzed. Results of analysis shown in Table II, indicated that a considerable fiber loss was experienced, amounting to 330 lbs. per ton of finished product. A study with the mill was immediately made to reduce these losses. Changes made resulted in reuse of some white water and reduction in white water discharge by closing up the system.

Flow measurements were again made, as previously described, with the results shown in Table III. It is apparent from the data in this Table, that by closing up the system as much as possible, a reduction in waste volume of 75.7 per cent was accomplished. All data have been considered from the standpoint of gallons per ton of product, since at the time of measurement, installation of a new cylinder machine was contemplated.

Table I
FLOW DATA
PRIOR TO CLOSING-UP SYSTEM

Date	Gals. of Waste per Ton of Product
7-22-47	26,172
7-30-47	25,339
8- 5-47	32,523
Average	27,767

Fig. 1—WEIR for measuring waste flow

Chemical Analysis of Waste

A study of Table II indicates that there was little change in the average pH, alkalinity and chlorides, after the mill water system was closed up. The average total solids is considerably lower with a higher percentage of volatile matter. The average suspended solids and settleable solids after close-up is about one-half of the earlier results, indicating an increase in fiber recovery within the mill. Dissolved solids have not increased appreciably, in spite of reuse of water. It should be noted that close-up of the system has increased oxygen consumed and B.O.D. values of the waste.

Methods of Study

With the aims of treatment, as stated previously, in mind and with a background of flow data and waste concentration, it was decided to install several types of pilot plant equipment. These were selected to determine the most effective treatment having the lowest initial installation cost and the least operating cost. Studies were made using vacuum filtration equipment, pressure filtration equipment, sedimentation equipment with and without chemical treatment, and high rate sedimentation. The work done and data collected were limited by considerations of time, cost and the lack of laboratory facilities at the mill.

Vacuum Filtration

The first pilot plant study was made using a rotary drum vacuum filter. Leaf tests, using nylon cloth, indicated rates of 60-90 gal. per sq. ft. per hr., with free discharge of filter cake, were possible.

A pilot size vacuum filter, measuring 3 ft. in diameter and 2 ft. long, set in a feed tank provided with elliptical skew agitators, was used.

*Gilbert Associates, Inc.
**Norristown Magnesia & Asbestos Co.
***Lowe Paper Co. (Formerly, Gilbert Associates, Inc.)

The feed consisted of partially settled white water. Fig. 2 is a flow diagram of the equipment used.

Although the leaf tests had indicated free removal of filter cake, in actual operation the filter cake did not form as expected and the fines, as asbestos rock talc and starch, quickly blinded the filtering nylon. The cloth could be cleaned successfully with a 5 per cent hydrochloric acid rinse and restored to use. Various other nylon cloths, more coarsely woven, were tried, but in each case they became "blind" to passage of filtrate by the second day of operation.

Leaf tests indicated that wool felts with relatively open weave and shaggy naps showed more promise of continued operation. When installed on the filter, the nap acted as a straining medium, allowing the fibers and fines to mat on it instead of entering the weave. The washing and lifting action of the water and air sprays raised the nap with the discharge of the cake, washing and freeing it of solids before entering the liquor again.

Laboratory analysis of the various feed and discharge liquors is shown in Table IV. It appears that the suspended solids in the raw waste varied considerably, and were higher than the raw waste data previously obtained, averaging 1315 ppm. After filtration, the suspended solids averaged 49 ppm., indicating a removal of 96.4 per cent through the filter. It should be noted that the rate of filtration varied for each run but, in spite of this variation, the effluent quality was fairly constant.

Operation results of the vacuum filter pilot plant indicated that consistent removal of suspended solids could be obtained, reducing the raw waste suspended solids approximately 96.4 per cent. The B.O.D. of the raw waste was reduced from 200 ppm. to 67 ppm. in the effluent on one run, by removal of starch and organic

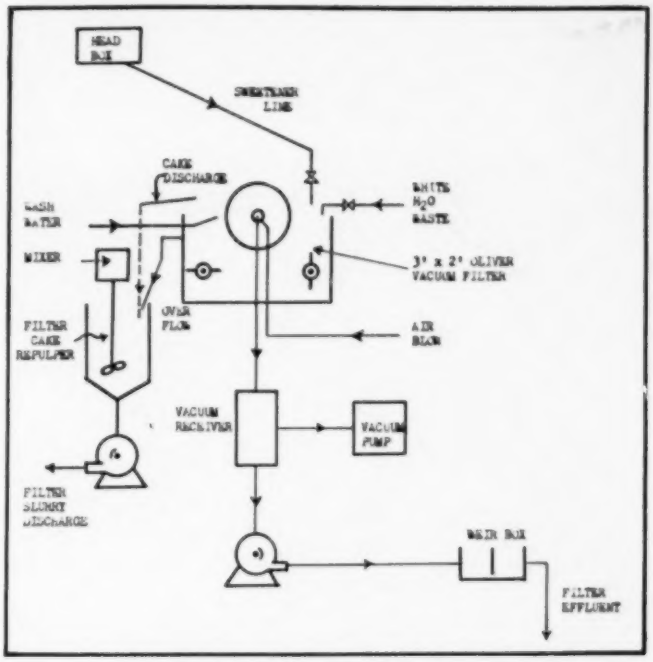


Fig. 2—VACUUM FILTRATION. Flow diagram of pilot plant.

Table III
Flow Data
System Closed-up

Date	Gals. of Waste per Ton of Product
5-12-48	6,614
5-13-48	6,165
5-14-48	7,443
Average	6,740

wood pulps from the white water. Data further indicated that with use of wool felt with occasional washings, in place of nylon filter media, continuous operation for a period of two weeks could be anticipated. However, the average filtration rate obtainable, 0.7 gal. per sq. ft. per min. would require a very large full scale unit for this installation.

Summarizing the operation of the vacuum filter pilot plant, results were not considered satisfactory for full scale operation. Cost of equipment, space limitations and labor for operation were such that installation of full scale equipment was not practical for this installation.

Pressure Filtration

Since vacuum filtration did not prove satisfactory for waste treatment, attention was directed to the use of pressure filters. Arrangements were made to install a pilot size diatomaceous earth filter for study. In

Table II
Laboratory Analyses
Raw Wastes

SAMPLE	RESULTS IN P.P.M.											POUNDS/DAY			POUNDS/TON		
	Total Alkalin.	Chlorides	Total Solids	Total Vol. Solids	Susp. Solids	Susp. Vol. Solids	Dissolved Solids	Oxygen Consumed	B.O.D	pH	Settleable Solids Ml/L	B.O.D.	Susp. Solids	Dissolved Solids	B.O.D.	Susp. Solids	Dissolved Solids
Composite 2-22-47	112	33	1633	521	1114	288	519	232	118	7.5	130	1130	10650	5000	25.7	242	114
Composite 2-30-47	115	59	2469	803	1692	417	777	260	100	9.1	110	950	16200	7500	2.1	360	166
Composite 8-5-47	108	24	2350	611	1440	165	910	156	175	8.4	100	1670	13800	8750	47.2	389	247
AVERAGE 1947	112	39	2151	678	1415	290	735	216	131	8.3	113	1250	13550	7083	31.3	330	176
Composite 5-12-48	102	37	812	488	276	164	536	292	283	7.3	19	660	645	1270	15.2	14.8	29.4
Composite 5-13-48	76	45	1341	775	728	308	613	296	180	9.2	43	420	1700	1470	9.0	36.9	31.5
Composite 5-14-48	198	51	1948	626	1140	268	808	290	105	6.0	150	252	2730	1940	6.5	70.6	50.1
AVERAGE 1948	125	44	1367	630	715	247	652	293	189	7.5	71	444	1692	1567	10.2	46.8	37.0

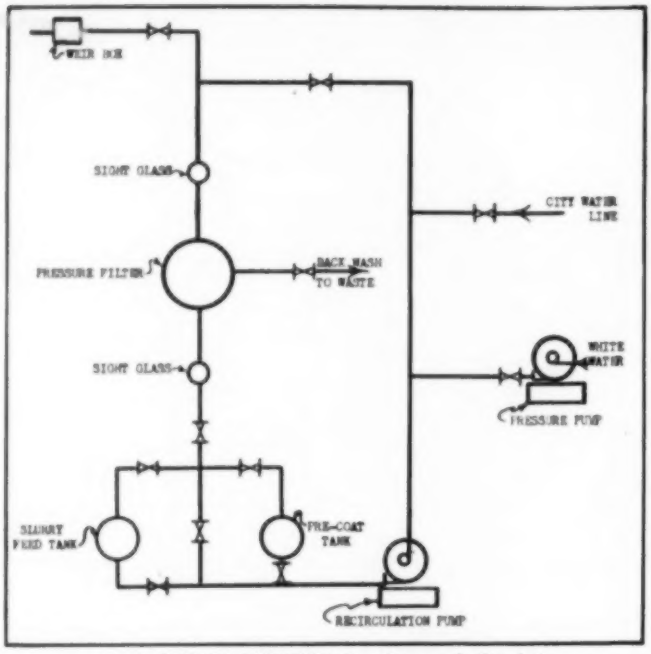


Fig. 3—PRESSURE FILTRATION. Flow diagram of pilot plant.

installing the pressure filter equipment, there was little doubt of the ability of pressure fitration units to more than adequately clarify the white water waste for any use to which it might be subjected. The questions to be answered concerned length of cycle, filter aid requirements, and maintenance necessary to keep the equipment in running order.

The filtering equipment installed consisted primarily of a pressure vessel containing filtering elements having a surface area of 42 sq. ft. Preceding this unit was a diatomaceous earth slurry feeder of the erosion type for maintaining continual additions of filter aid to render the filter cake more permeable, and a small tank to supply the initial precoat to the screens. The piping was arranged to form a closed circuit between these units and a small circulation pump was used to recycle the clear water during the precoat operation. The white water to be filtered came from a high pressure pump drawing from the effluent of the Bird Save-all unit. Also tied into this system was a 2-inch water line from the municipal supply and appropriate backwash valve. The effluent from the filtering unit was conducted through a sight glass and up overhead through a 60° V-notch weir box, discharging back into the system. A flow diagram detailing this installation is given in Fig. 3.

The filtering cycle consisted of first applying a layer of diatomaceous earth to act as a removable filtering medium by recycling 5 to 10 lbs. of this material in water until the appropriate layer was built up on the filter screens and the water recycled appeared clear in the sight glass. At this point, the slurry feeder was brought into operation to supply a small continual addition of the filter aid into the main feed line leading to the filter. The adjustment was made with hand valves in such a way that differential operating pressure of 8 to 10 lbs. was maintained through the slurry feeder. At this point, return lines, operating as a closed cycle through the recirculation pump, were closed off along with any outside additions of city water; and the white water feed lines, under pump pressure were slowly opened in conjunction with the opening of the filter effluent valve controlling the discharge of the filtrate to the weir box.

The filter operated at substantially a constant rate of discharge, the pressure differential between the effluent and the influent building up slowly, due to the gradual accumulation of a layer of impervious wastes being filtered out. After a variable length of time, depending upon the concentrations of the solids and the raw waste handled, the filtering rate would slowly fall away to a point where the filter's operating pressure was exceeded and operation had to be stopped. The final maximum pressure was empirically determined by the degree of packing of the waste solid within the filter shell. Too high final pressure would pack the solids to such an extent that it was impossible to readily remove them from the filtering screens by ordinary backwashing.

Having reached this maximum operating pressure, the feed and filtrate lines were valved off, and clear water for backwashing (in this case water from the city lines) was valved into the filter shells. The backwash line, which was fitted with a quick opening gate valve, was then opened and closed rapidly to induce a hydraulic shock through the filtering vessel, knocking the precoat waste layers from the screens into the bottom of the filter shell, where they were flushed to waste.

Operating results indicated that during a 3-hour test run, the flow rate dropped from 35 gpm. to 1.5 gpm., with a pressure increase from 4 psi. to 36 psi.

As filter aid, J. M. 503 and Dicalite Speedex were used. Preliminary tests indicated that the quantity of filter aid required varied with the white water condition, from 5.5 lb. to 16.5 lb. of Speedex per thousand gallon, at 20 lb. pressure.

Table IV
Laboratory Analyses
Vacuum Filter Operation

Date	Sample	Susp. Solids—ppm.	Percent Removal	Rate-Gal./S.F./Min.
1-20-49	Leaf Test	24		
1-21-49	Filter Effluent	8		1.16
1-24-49	Filter Effluent	6		0.116
4-10-49	White Water	966		
	Filter Effluent	47	95.4	0.398
	Filter Sludge	2,524		
4-17-49	White Water	862		
	Filter Effluent	61	93.1	1.09–0.695
	Filter Effluent	74	91.5	0.79
4- 4-49	White Water	2,116		
	Sweetening Feed	25,932		
	Mixed Feed	27,560		
	Effluent	55	97.1	.695
	Effluent	45	97.6	.790
	Effluent	54	98.2	.695
Average	White Water	1,315		
Average	Effluent	49	96.4	

Laboratory analyses of the various feed and filtrate liquors over the test periods are shown in Table V. A summary of this data indicates an average suspended solids reduction of 91.1 per cent and a total solids reduction of 58.2 per cent, producting a filtrate having an average turbidity of 18 ppm., suspended solids of 17 ppm. and total solids of 530 ppm.

Although the results, from an effluent quality standpoint, were good, operating problems overshadowed the end results. When the filter was dismantled after backwashing and the wire mesh was examined, it was found that "stapling" of waste asbestos fiber had occurred. It was very difficult to remove the fiber from the wire mesh, and its presence would progressively hinder the efficiency of the filtering units. Although rates between 1.0 and 1.5 gal. per sq. ft. of filtering area per minute were realized, the rapid build-up of cake within the limited space between the filter plates quickly decreased the rate of filtration. While no flow measuring devices were used to determine the amount of backwash required, it was judged from some of the twenty minute backwash periods required, that considerable quantities of water would be required for this use. The quantity and cost of filter aid was also undesirable.

Summarizing the results of precoated pressure filter studies, the initial operation produced highly clarified effluents, but continued tests showed the encroachment of fibers into the screens, backwashing difficulties in clearing the interior screen surfaces and possible excessive operation costs arising from the amounts of filter aid required. An examination of the operational data also shows that this type of clarification mechanism would probably be more suitably used as a polishing filter, if needed, following a primary clarification unit of another type capable of more flexibly handling the bulk of the waste load.

Fig. 4—SEDIMENTATION and flocculation studies made in this pilot unit.

Flocculation and Sedimentation

Although vacuum filtration and pressure filtration indicated that a high quality effluent could be obtained, cost and operating problems ruled out these methods of treatment for full scale installation. Attention was next turned to plain sedimentation, and sedimentation preceded by flocculation.

A pilot size settling tank, made up of a 55 gallon drum having a conical bottom and inner shell was installed for test purposes. Fig. 4 is a photograph of the sedimentation unit. The unit was first operated as a simple

Table V
Laboratory Analysis
Pressure Filter Operation

Sample	Turbidity	Suspended Solids	Total Solids	% Susp. Solids Reduction	% Total Solids Reduction
6-22-49					
Filter Effluent at Start	25	14	420		
Filter Effluent—1 hrs. Run	10	8	372		
Filter Effluent—2 hrs. Run	30	14	382		
6-23-49					
Composite of Filter Effluent During Run	8	6	669	99.5%	68.3%
White Water to Filter		1314	2103		
6-29-49					
Composite of Filtrate—1st Run	20	119	574	66.6%	41.5%
Composite of Filtrate—2nd Run	15	15	566	95.9%	42.4%
Composite of Filtrate—3rd Run	20	48	520	86.5%	47.0%
White Water to Filter		356	981		
6-30-49					
Composite of Filter Effluent—1st Run	18	16	604	99.3%	79.4%
White Water to Filter—1st Run		2018	2924		
Composite of Filter Effluent—2nd Run	25	19	663	98.8%	71.0%
White Water to Filter—2nd Run		1516	2275		

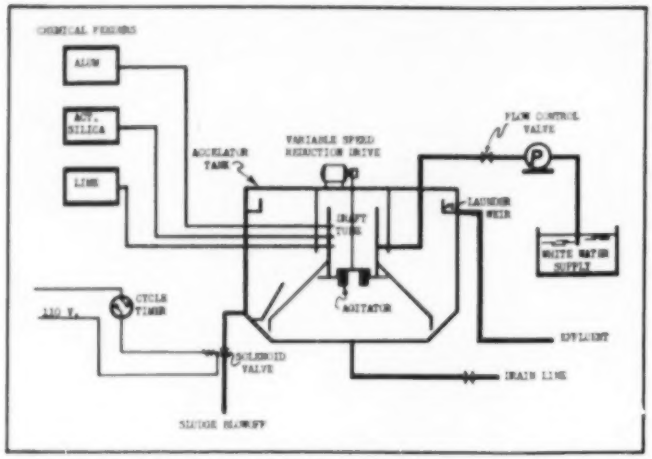


Fig. 5—HIGH RATE CLARIFICATION. Flow diagram of pilot plant.

settling tank, with the flow of waste entering the inner shell, flowing downward and then upward through a sludge blanket to the outlet. No chemicals for flocculation were used during the first runs. Results of the operation are shown in Table VI.

It appears that with one hour of detention time the turbidity was decreased considerably, the total solids were reduced approximately 50 per cent, and a light sludge having a concentration of 0.49 per cent was produced.

The second run was made with detention time reduced to one-half hour. Results of this run also are shown in Table VII. It is apparent that a minimum of one hour detention time is required to give reasonably practical results.

A third run was made, adding three grains per gallon of sodium aluminate as a flocculating agent. The results obtained, shown in Table VI, indicated very little increased efficiency due to the sodium aluminate.

In order to determine the effect pre-settling of heavier solids would have, a second pilot unit was constructed, and installed in series with the first unit. In two stage operation, the first unit was operated as a plain sedimentation tank, with no chemical additions, while flocculating agents were added to the waste in the second unit. Ferric chloride and lime were used as flocculating agents for the first run. Laboratory results indicating operation efficiency, are shown in Table VI. It should be noted that the second settling tank, employing chemical coagulation for removal of fine particles, did not improve the over-all efficiency appreciably. The sludge from the second unit was very thin, since the heavier solids were all removed in the primary unit.

A second run was made, using two stage operation. In this second run, 5 gpg. of alum and 2.5 gpg. of lime were added to the second unit for flocculation. On this run, the total detention time was first set at one hour, but was later increased to two hours, when it appeared that the floc formed was being carried out with the effluent. Results of chemical analysis taken during the test are shown in Table VI. It appears from the results that chemical flocculation on this run was effective in reducing turbidity, but at the same time increased total solids. Sludge was again thin, with only 0.23 per cent total solids.

A third run was made using two stage operation and 5 gpg. of alum and 10 ppm. activated silica were used as coagulating agents in the secondary unit. The results of the run, shown in Table VI, indicate excellent reduction in turbidity, suspended solids and total solids.

Summarizing the results of plain sedimentation and flocculation tests, it appears that plain settling for a limited period of two hours is not sufficient to provide an effluent acceptable for discharge or reuse. Chemical coagulation improves the settling quality of the waste, with a combination of alum and activated silica giving the best results.

It should be noted, at this point, that the results obtained in this study, both with sedimentation and coagulation procedures, can be considered only indicative of a preliminary approach to the final full scale equipment operation. Many operational difficulties and equipment limitations reduced the effectiveness of these initial pilot plant operations. Continuous runs, with the equipment operating under equilibrium conditions, should unquestionably increase the percentage removals. These tests were made primarily to show which process offered the most promise of treating this white water waste; the initial goal of this investigation being the production of a usable effluent for essentially complete return to the showers.

Table VI
Laboratory Analyses
Sedimentation and Flocculation

Run No.	Sample	Turbidity	Total Solids	Remarks
1	Influent	330	1,427	
	Effluent	95	728	Detention Time—1 hr.
	Sludge		48,898	
2	Influent	140	704	
	Effluent	100	555	Detention Time—½ hr.
	Sludge		32,329	
3	Influent	360	1,355	
	Effluent	205	692	Detention Time—2 hrs.
	Effluent	200	690	3 g.p.g Sod. Aluminate
	Sludge		40,925	
4	Influent	280	2,864	
	Effluent #1	135	821	
	Effluent #2	105	820	Ferric Chloride & Lime
	Sludge #1		29,718	
	Sludge #2		7,732	
5	Influent	230	2,091	
	Effluent #1	190	557	
	Effluent #2	75	581	5 g.p.g. Alum 2.5 g.p.g. Lime
	Sludge #1		22,711	
				Suspended Solids
6*	Influent	680	2,220	1007
	Effluent #2	55	481	45

* Note: 5 g.p.g. Alum and 10 p.p.m. Activated Silica added.

High Rate Flocculation And Clarification

Since the results of sedimentation, with coagulants added for floc formation, appeared to meet the requirements for reuse of water in the mill and stream pollution reduction, attention was directed towards use of

high rate clarification equipment. An Accelator demonstrator unit, manufactured by Infilco, Inc., was installed for trial operation. Fig. 5 is a flow diagram of this equipment installation.

The unit was operated 24 hours a day for ten consecutive days, shutting down only over the week-end with the rest of the mill or, for short periods, to clean out fibrous strings of asbestos fouling the agitator blades. During the first week, clarification was attempted without the addition of chemicals; during the second week, chemicals were added in doses indicated to be suitable by jar tests performed on the raw waste.

Composite samples were taken during the test period for the various days of operation. The results obtained from an analysis of these samples are summarized in Table VII.

Table VII
Laboratory Analyses
Pilot Accelator Unit

	Suspended Solids p.p.m.	Total Solids p.p.m.	Turbidity p.p.m.
Without Chemical Flocculation			
Raw Waste	1,449	1,921	438
Effluent	34	472	48
Sludge	11,160	12,239	
% Reduction	97.8	75.3	90.4
9 Grains/gal. Alum			
Raw Waste	2,164	3,002	900
Effluent	103	817	180
Sludge	9,342	11,097	
% Reduction	95.4	72.9	85.5
4 Grains/gal. Alum			
Raw Waste	2,456	2,843	670
Effluent	134	689	76
Sludge	11,667	12,181	
% Reduction	94.6	75.6	88.8
10 Grains/gal. Alum + 15 P.P.M. Activated Silica			
Raw Waste	2,108	2,898	750
Effluent	18	849	15
Sludge	9,456	11,267	
% Reduction	99.2	70.8	98.0

By visual observation, the unit performed very well, coming to equilibrium approximately an hour after a start-up. Very little attention was given to the operation of the unit other than occasional resetting of the sludge blowoff cycle necessary to balance the incoming solids. During the latter part of the test period, the turbidity remaining in the clarified water was low enough to observe the sludge as it spilled from the agitator draft tube and separated into a well defined layer in the settling compartments. Few if any, adverse currents were observed which could cause "mushrooms" of sludge to be surfaced and carried over the launder weirs.

Various types of asbestos fiber wastes were handled during the pilot plant test. These may be roughly classified into three groups which will respond to a similar degree of treatment: (1) Paper weights of 8 to 16 lbs. per square and the heavier millboard products use the long fibered asbestos base which tends to coagulate, given sufficient gentle agitation, without the use of chemicals. (2) The five or six pound papers and those used for the manufacture of insulation products within the mill are made from short fibered stock and scrap material which, generally being high in talc, required the addition of alum and activated silica to secure a clarified effluent. (3) Special products having additives of carbon black or silica powders required some alum dosage. Wool felt products which were not included in this test will probably require alum in proportion to the quantity of short fibered asbestos or scrap added to the stock.

On the basis of observation of these trials, a 5 gpm. rate was selected and used for all but the concluding day's operation. This final run was made with a 2.5 gpm. rate. A higher degree of clarification was obtained during the run with the longer detention period, but the addition of another variable in the form of the activated silica dosage prevents any conclusion as to the relative merit of increased detention time. The 5 gpm. flow corresponds to one hour and twelve minute detention or flow through time; the 2.5 gpm. to a two hour, twenty-four minute period. For short periods of time higher rates were tried with no apparent disturbing effect.

Table VII shows the average of analytical results from the various composite samples. A comparison of the type of waste and treatment efficiency can be obtained directly. As an overall average for the ten day period, the efficiency of removal was: for suspended solids, 95.8 per cent; for total solids, 74.5 per cent; for turbidity, 89.9 per cent, and for B.O.D., 47.5 per cent.

The quality of the effluent from the flocculation process was high. The quantity of suspended material still remaining was lower than that obtained by vacuum filtration; it compared favorably with or, in some instances, surpassed the removal efficiency experienced with pressure filtration. Furthermore, the effluent is capable of reuse for all shower and makeup water demands, sharply reducing the expense of city water consumption.

The sludge as removed from the pilot clarifier appeared to be capable of reuse back in the paper machines. Its average concentration of 1.08 per cent was approximately identical to that of the paper stock slurry as fed to the machine chests.

Summarizing results of high rate clarification pilot plant studies, successful clarification tests using an Accelator demonstrator on asbestos white water wastes resulting from varied product production were conducted continuously for a ten day period. Flocculation and separation of solids without the use of chemical additives was found to be possible. Reduction of suspended matter from an average of 1910 ppm. in the white water to an average of 50.1 ppm. in the effluent resulted from test operation, an average of 97.4 per cent. Higher reductions (up to 99.15 per cent) were possible with controlled chemical addition and increased detention periods.

Conclusions

The pilot plant studies conducted at the plant of Norristown Magnesia and Asbestos Company cannot be considered an exacting scientific study of all methods of paper mill waste treatment. The results, however, are indicative of what may be accomplished with a minimum of time and expense.

It was apparent from the results of studies made that vacuum filtration and pressure filtration would provide an effluent fit for reuse in the mill. Sludge problems were apparent, however, in conjunction with these methods. Cost of installation, as well as operation, indicated that sedimentation, with or without chemical coagulation, would give the desired results.

On the basis of the data collected, and conclusions drawn, it was decided to install an Infilco Cyclator for full scale operation. A unit having a capacity of 1200 gpm. has been constructed and has given efficient results for four months. The installation and operation of the full scale equipment will be described in a subsequent article after sufficient operating data have been collected.

Method of Estimating Sewage Plant Costs

by JOSEPH C. FEDERICK, *Asst. Dist. Engr., District No. 3, N.Y. State Dept. Public Works, Syracuse, N.Y.*

THE first question asked by municipal officials when faced with the necessity of providing a sewage treatment plant to treat the community's wastes is "What will it cost?" Public works departments and other agencies assigned the task of preparing designs and contracts for these facilities are confronted with the same inquiry. Budgetary and fiscal control authorities also request cost data in support of budgetary allocations for funds to progress proposed installations.

Use of Estimating Equation

Per capita values are sometimes used to obtain rapid cost estimates. Although useful, estimates based on per capita data are subject to greater variation from the most probable cost than those predicated upon other available criteria because of variation in per capita sewage flow contributions. A more valid measure is the cost per million gallons of sewage treated per day, i.e., the use of a volumetric base. An estimating equation and diagram utilizing the latter criterion are presented based upon the cost of sewage treatment plants designed by the New York State Department of Public Works for facilities under the jurisdiction of State Departments and Agencies. Contracts are prepared and awarded by the Public Works Department. The construction of the plants is also supervised by that agency.

Reliability of Data

As the information presented is derived from data confined to a single region, it makes the use of a cost equation particularly applicable to that area. Regional cost differentials that would prevail for data on a nation-wide basis are not present to distort the pattern. The reliability of the data is further enhanced by the fact that similar structural design standards for plant structures were utilized for all plants.

Furthermore, all plants included in the study treat sewage with substantially the same characteristics. The strength of the sewage as measured by B.O.D. varies from 170 ppm to 240 ppm. The sewage is domestic in character and includes no unduly large quantities of the usual wastes from laundering, dairying, slaughtering, and canning operations.

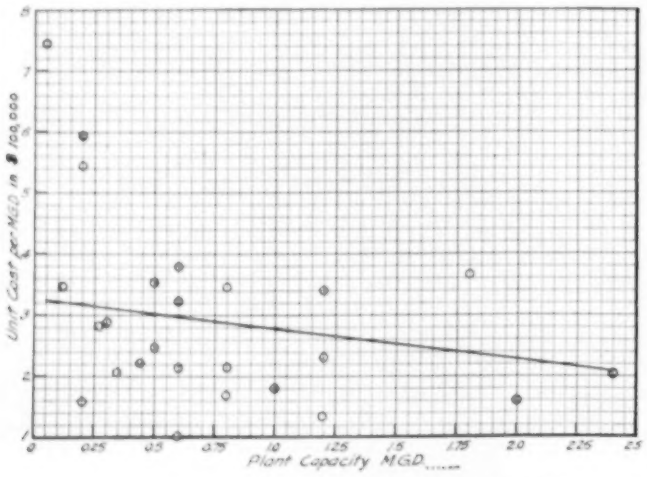


FIG. 1—CONSTRUCTION COST OF SEWAGE TREATMENT PLANTS
Most probable cost based upon estimating equation
$C = 3.26 - .493\ Q$
All data adjusted to 100% efficiency and ENR cost index base of 1926

Variability occasioned by the use of a sample with a large percentage of plants furnishing intermediate or primary treatment that must be converted to a 100 per cent efficiency is minimized. Sixty-three per cent of the plants of the sample gave complete treatment. The sample as utilized may be considered a representative, controlled sample.

Range of Plant Capacities

Plants considered in developing the estimating equation have capacities which vary between the limits of 50,000 to 2,400,000 gallons per day. With a per capita daily sewage contribution of 80 gallons such plants would serve communities with populations as great as 30,000. The institutions served by plants of the maximum capacity noted have populations of only 12,000 people. The discrepancy that would be present in an estimate based on per capita data is evident.

The types of plants include primary treatment, using Imhoff tanks or clarifiers with separate sludge digestion; trickling filters, employing both fixed nozzles and rotating distributors; intermittent sand filters, with natural and artificial sand beds; and activated sludge plants.

Included in this analysis are the 27 plants listed in Table I. The plant costs used are the final estimates upon which payments were made to the contractor.

Adjustment of Data

In preparing the data for use all plant costs are converted to 1926 as a base using the Engineering News-Record construction cost index. This procedure was followed to permit comparison with the results of a study of sewage treatment plant costs made by Velz[1]. It is to be noted that the ENR construction cost index diagram as given in current issues of Engineering News-Record is referred to the year 1913 = 100 as a base. To convert 1913 base values to 1926 =100, the 1913 index value is divided by 2.0803.

Each type of treatment is adjusted to 100 per cent efficiency by considering B.O.D. removals as follows: primary treatment—35%, trickling filters—85%, activated sludge—90%, and intermittent sand filters—95%.

Derivation of Estimating Equation

The relationship between size of plant in mgd. and unit cost per mg. based on design capacity is illustrated in Fig. 1. Statistical analysis of the data indicates a significant degree of correlation between the variables unit cost and size, with a coefficient of minus 0.31. As indicated by the negative sign of the coefficient the cost per

mg. decreases as size of plant increases. The estimating equation is derived from the curve of best fit.

The formula for the estimating equation as shown on the scatter diagram is

$$C = 3.26 - 0.493\,Q$$

In this formula C equals the cost in hundred thousand dollars per mg. and Q is the plant capacity in mgd. From the above formula the cost of a 1.0 mgd. capacity plant would be $277,000 per million gallons assuming 100 per cent efficiency.

The computed value of the scatter, or standard error of estimate, for the sample utilized is 1.656. Although the statistical term "standard error of estimate" is employed, the value is merely a general measure of the variation of the actual C or cost values from the computed C values of this particular sample of cost data. It furnishes an estimate of the range above and below the estimating equation line within which approximately two-thirds of the values will fall.

That is, based upon all the cost data utilized in the derivation, two-thirds of the plants with a capacity of 1.0 mgd. would vary in cost between $111,000 and $442,000. The most probable value would be $277,000. For other installations this holds true provided there are no qualifying considerations which would necessitate deviation from the type of construction or types of plants included in the sample. The width or range of the enveloping band may be varied to whatever limits desired by statistical methods.

Comparison With Other Data

A comparison with a similar type of cost study made by Velz covering the Northeastern and Central United States will be of interest[1]. His data included plants varying in size from 50,000 gal. to 750 mgd. Values picked from a diagram give the most probable cost for one and two mgd. plants as $165,000 and $140,000 per mg. These values compare with $277,000 and $227,000 per mg. obtained from the estimating equation given above. The estimates differ by approximately 40 per cent. The reason for this variation in the two sets of values is readily apparent. The wide range in plant capacities in the sample, with plants as large as 750 mgd., materially affect the smaller plant values. Also the differences in sectional and regional design standards and costs have a direct influence upon the comparative cost relationships.

Selecting the costs for ninety plants having capacities of 2.5 mgd. and lower from the plotted data on Velz'

Table I

SEWAGE TREATMENT PLANT COSTS—NEW YORK STATE INSTITUTIONS

Type of Plant and Institution	Year of Contract	Cost of Plant	Design Flow Mgd.	Plant Description
IMHOFF TANKS & SLUDGE BEDS				
1. Thomas Indian School	1935	$ 12,672	.05	Bar screen, Imhoff tank, sludge beds. All under glass.
2. Women's Relief Corps Home	1948	58,539	.1	Bar screen, Imhoff tank, sludge beds. All under glass. Chlorination.
3. West Haverstraw R. H.	1933	30,968	.2	Bar screen, Imhoff tanks, sludge beds. Pre-chlorination.
4. Matteawan S. H.	1931	39,154	.6	Bar screen, Imhoff tanks (2), sludge beds. All under one glass house. Pre-chlorination.
5. Clinton Prison	1931 1933	62,396 } 6,484 }	.6	Bar screen, Imhoff tanks, sludge beds. All under one glass house. Pre-chlorination.
6. Letchworth Village S. H.	1928 1935	40,113 } 16,667 }	.8	Bar screen, Imhoff tanks, glass covered sludge bed. Chlorination.
CLARIFIERS WITH SEPARATE DIGESTERS				
7. Sing Sing Prison	1949	333,066	.6	Screen, clarifiers, separate digesters, glass covered sludge beds. Chlorination.
8. Hudson River S. H.	1931	84,043	1.2	Grit chamber, automatically cleaned bar screen, clarifiers, digester, sludge beds. Pre- and post-chlorination. Clarifiers and sludge beds under glass.
9. Gowanda S. H.	1937	109,134	.8	Automatically cleaned bar screen, clarifiers, digestors, vacuum sludge filters, all covered. Pre-chlorination.
TRICKLING FILTER PLANTS				
10. West Coxsackie T. S.	1934	33,200	.12	Bar screen, Imhoff tank, rotating trickling filters, final tank. Pre- and post-chlorination.
11. Woodbourne S. H.	1933	82,185	.2	Bar screen, Imhoff tanks, rotating trickling filters, final tank. Tanks and sludge beds under glass. Pre- and post-chlorination.
12. Wallkill Prison	1933	31,968	.2	Bar screen, Imhoff tanks, sprinkling filter, final tank, glass covered sludge bed.
13. Napanoch Institution	1931	51,619	.34	Bar screen, Imhoff tanks, rotating trickling filters, sludge beds.
14. Great Meadow Prison	1931	72,200	.44	Bar screen, Imhoff tanks, sludge beds, rotating trickling filters, all under glass.
15. Attica Prison	1930	94,549	.5	Bar screen, Imhoff tanks, sprinkling filters, final tank, open sludge beds. Chlorination.
16. Rome State School	1930	36,152	.6	Bar screen, Imhoff tanks, sprinkling filters, sludge beds. Barge Canal.
17. Willard S. H.	1935	109,060	.8	Automatically cleaned bar screen, clarifiers, sprinkling filters, final tank, digestors, glass covered sludge beds. Pre- and post-chlorination.
18. Marcy S. H.	1936	151,614	1.0	Automatically cleaned bar screen, clarifiers, sprinkling filters, final tank, digestors, glass covered sludge bed. Pre- and post-chlorination.
19. Wassaic State School	1929	136,207	1.2	Bar screen, Imhoff tanks, sprinkling filters, final tanks, chlorination, sludge beds.
20. Rockland S. H.	1929 1934 1936	341,460 } 59,938 } 151,479 }	1.8	Automatically cleaned bar screens, Imhoff tanks, sprinkling filters, final tanks, glass covered sludge beds, storage tanks for peak flow, pre- and post-chlorination. All effluent pumped.
21. Greenhaven Prison	1939	170,563	0.5	Bar screen, clarifiers, digestors, rotating trickling filters, final clarifier, vacuum sludge filter. Pre- and post-chlorination.
INTERMITTENT SAND FILTERS (ARTIFICIAL BEDS)				
22. Harlem Valley S. H.	1930	80,000	.3	(Replaced)
23. Craig Colony	1935	174,131	.6	Automatically cleaned bar screen, Imhoff tanks, sand filters, sludge beds.
(NATURAL BEDS)				
24. Central Islip S. H.	1934 1937	270,536 12,011	2.0	Automatically cleaned bar screens, clarifiers, digestors, sludge beds, natural sand filters, pre-chlorination.
25. Pilgrim S. H.	1931 1934 1935	227,819 } 123,494 } 55,584 }	2.4	Automatically cleaned bar screens, Imhoff tanks, sludge beds, natural sand filters, pre-chlorination. All sewage pumped.
ACTIVATED SLUDGE PLANTS				
26. Harlem Valley S. H.	1932	277,520	1.2	Automatically cleaned bar screen, clarifiers, mechanical aeration, final tanks, digestors, glass covered sludge beds, pre- and post-chlorination.
27. Kings Park S. H.	1935	270,010	2.0	Automatic cleaned bar screen, Grit chamber, clarifiers, mechanical aeration, final tanks, digestors, glass covered sludge beds, vacuum filter, pre- and post-chlorination.

diagram, and deriving an estimating curve for this sample, furnishes a probable cost for a 1.0 mgd. capacity plant of $215,000 per million gallons. This value is about 22 per cent less than the $277,000 estimate obtained by the writer's formula. Location cost differentials and design standards can easily account for a large part of this variation. The two sets of values show substantial agreement. As is to be expected, however, narrowing the range of plant capacities and diminishing the size of the sample also lowers the correlation coefficient obtained in the initial study.

Application of Diagram or Formula

The formula and diagram will be useful in making initial cost estimates for plants with required capacities within the range indicated. Such estimates may be required quickly for presentation to citizen groups or public bodies. The data can be of value to control agencies, such as budgetary authorities, in ascertaining the reasonableness of cost estimates submitted by various departments when requesting funds for contemplated programs.

Although it is believed that the estimating equation or diagram will be of material assistance in obtaining a quick estimate, it is not intended to replace cost predictions based upon preliminary or complete plant designs. When time permits the latter procedure should be followed.

The use of the diagram or equation may be illustrated by the example which follows.

A consulting engineer is asked for an immediate cost estimate for a plant to serve an ultimate population of 20,000 persons. The stream into which the plant effluent is to be discharged has a flow and dissolved oxygen content such that complete treatment equivalent to activated sludge is necessary. The plant is to be bid in the current year. The ENR Index is 520.

At 100 gal. per capita per day, the plant capacity required is 2.0 mgd. From the estimating equation the cost for a 2.0 mgd. capacity plant is $227,000 per mg. for 100 per cent efficiency. With 90 per cent removal and an activated sludge plant and the ENR Index at 520 the plant cost will be

$$2.0 \times \$227{,}000 \times 0.90 \times \frac{5.20}{2.080.3} = \$1{,}021{,}000$$

This estimate is the construction cost of the treatment plant only. All other necessary charges would add to the plant costs. Where unusual construction conditions are expected to be encountered, that situation must be given consideration in adjusting the estimate.

Reference

1. Velz, C. J., "How Much Should Sewage Treatment Cost?" Eng. News-Record, p. 85, Oct. 14, 1948.

New Sewage Treatment Projects First Quarter of 1952 To Cost $27 Million

Municipalities have awarded contracts for the construction of 111 sewage treatment plant projects during the first quarter of 1952, the Public Health Service of the Federal Security Agency reported recently. These 111 projects in 33 states involve a total cost of about $27 million. Over 2 million people will receive new or improved service when these projects are completed.

Surgeon General Leonard A. Scheele pointed out that the projects are the result of the work of state and interstate water pollution control authorities. "These agencies have been leading the nation-wide attack on the problems of pollution which constitute a major threat to our vital water resources in many parts of the country," Dr. Scheele said.

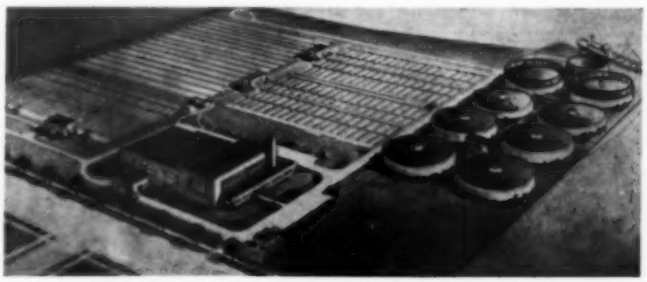
Of the 111 projects reported, 72 are new plants being built at a total cost of about $17 million. The other 39 consist of additions, enlargements or replacements of existing plants.

Dr. Scheele said, however, that the current rate of investment in sewage treatment works construction is far short of the rate required to solve the pollution problem in this country.

"Comparison with construction figures for the same months of previous years," he said, "reveals that the present rate is less than the average for the years 1948-1952. It meets only about one-fourth of the need for catching up with the backlog and for meeting new needs arising from the growth of our cities and industries."

"In addition," he said, "existing plants must be replaced as they become obsolete. This will become increasingly important as more and more plants built 20 or 25 years ago reach a point where their effectiveness is sharply limited."

Data are not available on progress in the abatement of industrial wastes, the other major source of water pollution. A national summary report published by the Public Health Service in 1950 showed that of the 10,400 industries known to be discharging wastes, nearly 3,500 needed new or additional waste treatment facilities while over 5,500 more had undetermined needs.



N.Y. City Places Ninth Major Sewage Treatment Plant in Operation

The Hunts Point Sewage Treatment Plant of New York City was placed in operation June 20th, with Mayor Impellitteri and Comm. of Public Wks. Zurmuhlen officiating. It represents the ninth major Pollution Control Project to be completed in the city's program of sewage treatment for the entire city.

The Hunts Point Plant serves a population of 770,000 in the Bronx area and will treat 120 mgd. of sewage. The project, costing $22,258,000, employs the low-cost "step aeration modification of the activated sludge process" developed by engineers of the N. Y. City Dept. of Public Works under the guidance of Richard M. Gould, Director, Div. of Engineering, and Wellington Donaldson, Deputy Director of Sewage Disposal.

Sludge will be digested to reduce its bulk and to recover gas for power production and heating. The digested sludge will be barged to deep-sea dumping grounds in N.Y. City's specially designed seagoing sludge-vessels which have proved so practical in connection with other N. Y. City plants.

Sewage Chlorination Mechanism

A Survey of Fundamental Factors

by ISADORE NUSBAUM, *Pollution Control Engr., Region No. 9, Water Pollution Control Board, San Diego, Calif.*

THE use of chlorine for the disinfection of wastes precedes even the great bacteriological discoveries of the nineteenth century.[1] However, this use of chlorine was rapidly replaced in sanitary significance by the chlorination of potable water supplies for bacteriological purposes and for taste and odor control. With few exceptions, almost all studies which have been made with respect to the mechanism of the chlorination of dilute aqueous solutions relate to potable water treatment. A search of the text and bibliography of the recent publication, "Chlorination of Sewage and Industrial Wastes," reveals little fundamental information which applies specifically to sewage chlorination.

The chemistries of sewage and water chlorination are basically the same and, in general, differ only in the quantities present of materials which affect chlorination efficiency. The similarity has led to a false confidence in chlorination as applied in sewage treatment and to some fallacies in the control of this process. It is difficult to perceive the significance of statistical approaches to sewage chlorination or efforts to predict or stimpulate bactericidal effects of chlorine dosage without satisfactory knowledge of the active agent in sewage chlorination or adequate means of measuring this constituent.

Basic Chlorination Reactions

The purpose of this paper is to indicate certain basic reactions in sewage chlorination and to emphasize the influence of certain chemical and physical factors on the efficiency of chlorination of dilute aqueous solutions for bacterial control. No attempt will be made to reference all the literature from which material was obtained. However, the references cited include several comprehensive reviews of literature which cover most of the important sources up to the current material.[1, 2, 3, 4]

Chapin,[5] in the now classical description of chloramines in aqueous solutions, established a relationship between the quantities of mono-, di- and trichloramines existing at various pH values for (in water and sewage) a relatively concentrated solution of these substances. Subsequent investigations[6, 7] have shown that in the dilute solutions found in chlorination practice this relationship is substantially correct. However, the studies of Chapin and other investigators were made at weight ratios of chlorine to ammonia nitrogen of 1:1 or greater. The formation of the chloramines is essentially a step-wise reaction as follows:

$$NH_3 + HOCl \rightarrow NH_2Cl + H_2O$$
$$NH_2Cl + HOCl \rightarrow NHCl_2 + H_2O$$
$$NHCl_2 + HOCl \rightarrow NCl_3 + H_2O$$

Chapin found that above pH 8.5 only monochloramine is formed, varying combinations of mono- and dichloramine appear between pH 8.5 and 5.0 and dichloramine alone exists between pH 4.4 and 5.0. Below pH 4.4 nitrogen tricholoride appears.

It was found[8] that the ratio of mono- to dichloramine is controlled by the equilibrium

$$2NH_2Cl + H^+ \rightleftarrows NH_4^+ + NHCl_2$$

and the equilibrium constant was expressed

$$\frac{(NH_4^+)\ (NHCl_2)}{(H^+)\ (NH_2Cl)^2} = \text{Keq.} = 6.7 \times 10^8 \text{ at } 25^\circ\text{C}$$

Thus the concentration of the hydrogen ion was found to be the most important influence in determining the relative amounts of NH_2Cl and $NHCl_2$.

The influence of ammonium ion concentration must not be ignored since, in raw and primary sewage, normal ammonia nitrogen is in the neighborhood of 15-30 ppm and frequently may exceed 30 ppm. Calculations using the above equilibirum expression for ammonium ion concentrations of 20 to 30 ppm and residual available chlorine concentrations of 1 to 2 ppm indicate that even at pH 5.0 the available chlorine present as the monochloramine exceeds 90 per cent of the total in solution and that at pH 7.0 the quantity of dichloramine is negligible. Using the methods of Marks et al[9] and Palin,[7] and similar concentrations of chlorine and ammonia both in sewage and distilled water, it was found that at pH 6.0 or greater dichloramine was not detectable. This evidence is submitted for proof that the primary source of germicidal chlorine in sewage is monochloramine. Hypochlorous acid or free chlorine is present only fleetingly[9] in measurable quantities in sewage chlorination, and thus has no significant effect on bacterial numbers.

Bactericidal Power

The effectiveness of monochloramine as a disinfectant and the comparative bactericidal efficiencies of mono- and dichloramine must then be considered. It is the opinion of the writer, based on observation and information gleaned from the literature, that there is no great difference between the effectiveness of mono- and dichloramin as germicides. This is contrary to the findings reported by the workers at Harvard[6] in several papers and by other investigators. However, these reports have in no case separated or evaluated the effect of pH value apart from the varying ratio of monocholoramine to dichloramine. This will be discussed at greater length later in the paper.

Butterfield and Wattie[10] reported that the presence of excessive amounts of ammonium nitrogen (Cl:N ratios up to 1:25) did not markedly reduce the bactericidal efficiency of the resultant chlormines. Levine and Weber[11] noted no significant differences between the germicidal activities of chloramines at the same pH but different ammonium nitrogen concentrations. Cl:N ratios ranged from solutions in which dichloramine predominates to solutions containing only monochloramine. In a series of investigations by the writer on the chlorination of primary sewage effluent it was found that the rate of destruction of coliform organisms in sewage containing 15 to 30 ppm ammonium nitrogen and 1 to 3 ppm available

chlorine (as determined by the amperometric method) was comparable to the rate found in potable water disinfection with chloramines.

In addition, although the redox potential theory of the germicidal action of chlorine has been generally discarded, the oxidation potential may still be considered a measure of the germicidal activity of free chlorine. Monochloramine has a higher oxidation potential than dichloramine as evidenced by the ability to discharge its stoichiometric equivalent of iodine from iodide at pH 7.0. Since the chloramines are toxic to bacteria in extremely small concentrations, it is difficult to believe that the mechanism of toxicity for chloramines is essentially different from that of free chlorine (hypochlorous acid).

Effect of pH

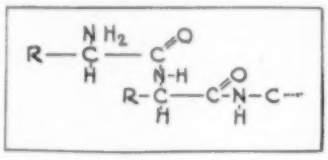
It has long been known that mineral acids have a marked bactericidal effect which appears to be proportional to the hydrogen ion concentration.[7] Acids in concentrations too low to kill bacteria rapidly often enhance the activity of other disinfecting agents. Also bacteria have an optimum pH value for growth, an optimum pH value for survival and a pH value at which the acid tolerance of the organism fails. The acid tolerance of B. coli (now termed Esch. coli) fails at about pH 4.6 which for Cl:N ratios of 1:1 or greater is approximately the point of maximum dichloramine residuals. It would appear rather difficult to evaluate dichloramine alone as a disinfectant in this pH range and to eliminate the concomitant catalytic effect of pH on disinfectants or low tendency for B. coli to survive.

Rahn and Conn[8] observed a marked increase in antiseptic efficiency with an increase in acidity. They noted that in the case of such antiseptics as benzoic acid the undissociated acid which exists at lower pHs was much more toxic than the dissociated molecule at pH 7.0 to 8.0. It was also found that in killing B. coli 100 times as much sulfurous acid was required at pH 8.0 as at pH 6.0. At pH 8.0 the SO_3 ion predominates and at pH 6.0 HSO_3 is the principal ion. It was impossible to evaluate HSO_3 as compared to undissociated H_2SO_3 since the toxic effect of increased hydrogen ion concentrations interfered. Degering and associates[9], following a series of studies on the effect of pH on the properties of commercial antiseptics, postulated the theory that the hydrogen-ion effect may be independent of the molecular structure of the antiseptic compounds provided that instability or insolubility in acid media are not interfering factors.

In the summary of the Public Health Service research[2] into the influence of pH and temperature on the survival of coliforms and enteric pathogens when exposed to free chlorine and chloramines the same intensifying effect of hydrogen ion concentration on germicidal properties is clearly shown. For free chlorine this is ascribed to the greater disinfectant properties of undissociated HOCl which is present at the lower pH level. The enhanced properties of the chloramines have been attributed to the higher concentration of dichloramine at low pH which, as shown above, is probably not so.

Effect of Albuminoid-Nitrogen

The basic structure of proteins and peptides may be characterized as follows:



The primary amino groups which are present in the protein, peptide and amino acid structures are one of the principal sources of albuminoid nitrogen in sewage. Compounds such as urea also contribute to the albuminoid nitrogen. Hypochlorous acid and monochloramine react with the albuminoid nitrogen from protein sources to produce chloramines. Research has shown these compounds to be germicidal in nature but of a much lower order of activity than free chlorine or chloramines.

In sewage this albuminoid nitrogen is present in concentrations of about 1 to 5 ppm except where the sewage contains large amounts of proteinaceous industrial wastes. With normal NH_3-N concentrations in sewage of 15 to 30 ppm, the first reaction upon addition of HOCl is to form monochloramine which in turn reacts slowly with the albuminoid nitrogen. This reaction is suppressed by the presence of excess ammonium ion. When the concentration of albuminoid nitrogen is high or the ratio of ammonium nitrogen to albuminoid nitrogen low the formation of the protein chloramines is accelerated and the predominant bactericidal action is that of the albuminoid nitrogen chloramines. These facts tend to account for some of the erratic results that have been encountered particularly in raw or primary sewage.

There have been many reports in the past fifty years on the comparative germicidal properties of chlorine and chloramines, and of chlorine, bromine and iodine, in which superior bactericidal effects have been attributed to the chloramines and to bromine and iodine. With few exceptions an investigation of this literature has shown that the experiments have been conducted with excessive amounts of albuminoid nitrogen in solution and that the chlorine immediately formed albuminoid nitrogen chloramines. The source of the albuminoid nitrogen has been the bacterial inoculuum used which, in these cases, was generally from broth cultures having high peptone or protein concentrations. In investigations conducted by the writer, using both water and sewage, the presence of small amounts of peptone, gelatine or bacterial culture media completely changed the effectiveness of the chlorine residual without changing the residual appreciably.

Summary and Conclusion

The fundamental aspects of sewage chlorination are essentially the same as for water chlorination. These basic concepts must provide the groundwork for understanding and improving sewage chlorination practice. The important agent in the disinfection of sewage by chorination is mono-chloramine. Dichloramine rarely is found in sewage chlorination and there is in all probability little difference in the germicidal activity of mono- and dichloramine. The effect of increased hydrogen ion concentration in enhancing the germicidal efficiency of chlorination cannot necessarily be related to the ratio of monochloramine to dichloramine or the presence of one material to the exclusion of the other. Albuminoid nitrogen concentrations may be an important factor in the efficiency of sewage chlorination and definitely provide an unevaluated interference in much of the research on chlorine antisepticity.

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South Dakota Short Courses Resumed

The Water Works Operators' Short Course, sponsored jointly by the South Dakota State College, the South Dakota Water and Sewage Works Conference, and the South Dakota Department of Health has been resumed. The 1952 school was held at the State College in Brookings, S.D. The first such course in South Dakota was held in 1941 at the University at Vermillion.

Attendance at the 1952 school consisted of 26 operators, representing 22 communities in the state. Considering that the school was held while the echoes of the greatest flood in Missouri River history were still prevalent and many communities had just started their cleanup program, the attendance was considered good. In fact the Sioux and James Rivers were still rampaging, with all of the misery, hard work, and potential dangers incidental thereto.

One of the highlights of the school was the talk by Sam Van Hise, relating the City of Pierre's experiences with its water supply during the flood. This presentation stimulated more discussion by operators from Missouri River plants and other flooded locations, dealing with their own experiences and improvisions to keep a safe water supply in the mains for public use and consumption.

Forty-one persons attended the banquet which featured the President of S.D. State College, Dr. J. W. Headley, as the principal speaker. Certificates of attendance were presented to the operators attending all sessions.

For this brief report and picture of the group South Dakota State College we are indebted to Chas. E. Carl, State Sanitary Engineer of South Dakota.

AWWA Conventioneers Consume 3408 Bottles.

3408 bottles of Coca-Cola is a lot of "coke," but that's the number of bottles that AWWA conventioneers consumed in the Exhibit Hall at the recent Kansas City Convention.

These "cokes" were on the house, having been brought in and served gratis by the Water & Sewage Works Mfrs. Association to one and all in the Exhibit Hall.

The peak days of distribution were the first two days of the convention when the thermometer shot up to a record 96° for early May in Kansas City—at least that's what the newspapers had to say about it.

Handbook of Chemistry and Physics in New 1951-1952 Edition

There are 2875 pages of readily available information in the new 33rd edition of the *Handbook of Chemistry and Physics*. Thus it provides an important tool for all scientists, technicians, teachers and students.

Among the sections of particular value to workers in the field of sanitation are mathematical tables, properties and physical constants, general chemical tables, quantities and units, and many miscellaneous types of data. The authorities who collaborate in the preparation of this volume provide a unique source of readily available references.

The *Handbook* is published by The Chemical Rubber Co., Cleveland 14, Ohio, at $7.50 per copy.

"WE THOUGHT you'd like to be comfortable and relaxed when you read OUR meter."

THE EDITOR'S COMMENTS

More Copper for Water Utilities and Equipment Manufacturers

A substantial relaxation on copper and aluminum for water utilities and for manufacturers of water and sewage works equipment was announced by the National Production Authority on June 18th.

Contemplated relaxation of controls on structural steel, which was to become effective July 1, has been postponed indefinitely as the result of recent developments in the production of steel. For the same reason all allocations of steel for other than direct defense needs has come to a temporary stand-still. However, all of the so-called tickets issued by N.P.A. for steel requirements in the water and sewage field will be honored, according to advice from G. E. Arnold, Director, Water Resources Div. of N.P.A.

Up to the advent of the steel strike it had been the announced intent of N.P.A. to change the designation of water and sewage works construction and maintenance from that of "Commercial" to that of "Industrial," such re-classification to have been effective July 1. The order making this helpful reclassification effective has now been withdrawn for an indefinite period, during which time C.M.P. Regulation 6 will continue to function.

Now, on the brighter side N.P.A. on June 18 released a relaxation order on copper and aluminum, effective immediately, which will be beneficial to water and sewage works, also of substantial benefit to manufacturers of water and sewage works equipment such as meters, motors, valves and hydrants, which fall into the category of Class B products in the Controlled Materials Plan.

Water and sewage works managements can now purchase up to 750 pounds of copper or copper alloys in each quarter under the self-certification plan of procurement. This compares with the previous limit of 200 pounds per quarter. Manufacturers of Class B products previously entitled to self-authorize purchases of copper up to 500 pounds per quarter can now self-authorize purchases up to 10,000 pounds total for each quarter—a twenty fold increase in permissive use of copper by those in the "small business" category. Larger manufacturers heretofore permitted to purchase up to 3,000 pounds of copper or copper alloys in each quarter can now purchase up to 20,000 pounds per quarter—a seven fold increase for the larger manufacturers.

The changed picture in permissive use of aluminum is more spectacular. Water and sewage works managements may now self-authorize purchases of up to 1,000 pounds of aluminum per quarter in contrast with none previously permitted. The smaller manufacturers previously permitted to purchase 1,000 pounds per quarter may now self-authorize purchases up to 20,000 pounds per quarter—a twenty fold increase. The larger manufacturers may boost their self-authorized purchases to 40,000 pounds per quarter as against the 4,000 pound limit previously.

In the matter of home construction (one to four family units) owners may now self-authorize purchases of copper and copper base materials for water piping in the amount of 175 pounds per dwelling unit for all uses, including the piping. Aluminum up to 250 pounds per unit is now permissive.

All of this is to say that there has been a substantial easing of controls on copper and aluminum because tickets issued by N.P.A. to applicants for these controlled materials have not been used to the extent that some non-defense users had claimed to be their true needs.

Another reason for the relaxation on copper controls is to be found in the recent increase of imported copper from Chile. Such has come about as the result of raising the ceiling price on the Chilean import to what is known as the world price of copper—namely, 33 to 35 cents per pound as against the 24½ cent ceiling on domestic copper. Manufacturers have been encouraged to purchase the foreign copper by permitting additional purchases of 6 pounds of the domestic at 24½ cents for every 4 pounds of Chilean copper purchased at the world market price of 33 to 35 cents per pound. Further, the Office of Price Stabilization agreed to permit manufacturers purchasing the foreign copper to pass on to the buyers of the products manufactured 80% of the increased cost of production created by the higher price paid for the world market copper.

Those manufacturers who went along on this government deal must now feel rather "goofy" considering the present relaxations on copper usage in civilian goods.

"No Pay, No Washee!"

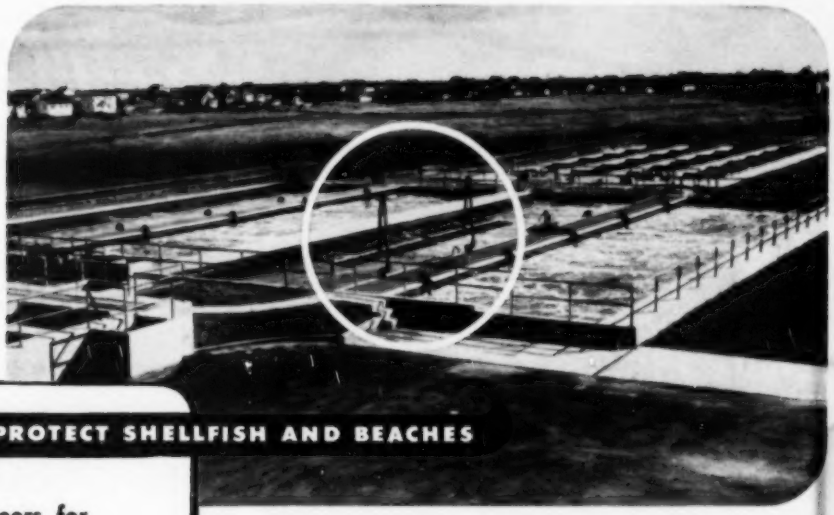
Just as we were commenting on the value of Wisconsin's Public Service Commission in guiding the operation and management of municipally owned utility systems an instance of such value has come to us in the form of a newspaper notice to the water takers of "Littletown," Wis. The published notice reads as follows:

City water consumers who "forget" to pay their water bills will find themselves without water service. The city authorities state that recommendations and instructions of the State Public Service Comm. relative to the handling of delinquent water accounts will be followed to the letter.

The instructions state that to all water bills remaining unpaid 15 days after billing a delinquency penalty of 10 per cent will be added. If the bill plus the penalty is not paid after 20 days the customer is to be notified of a water shut-off after the 25th day of non-payment, unless some acceptable arrangement is made in the interim.

This is but one illustration of how the State's P.S.C. makes life easier for water utility operators in Wisconsin.

L. H. Enslow



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Aeration Tanks, Fairfield, Connecticut Sewage Treatment Plant, with Chicago Swing Diffusers and Precision Diffuser Tubes. Air is supplied by three Chicago Standardaire Blowers. Two Blowers are direct connected to electric motors and have a capacity of 2000 cfm each at 6.5 psi. One Blower is direct connected to a gas engine and has a capacity of 2100 cfm at 6.5 psi. Design flow of the plant is 4 M.G.D. Bowe, Albertson & Associates, Engineers.

The City of Fairfield, Connecticut, is assured of continuous and economical operation of the aeration battery in their new Activated Sludge Sewage Treatment Plant. Bowe, Albertson & Associates, Engineers, specified a Chicago Air Diffusion System to provide complete equipment for sewage aeration. Everything necessary from air to water is specifically designed and engineered as a unit to treat sewage and industrial wastes. The Chicago Standardaire Blower, Swing Diffusers and Precision Diffuser Tubes provide efficient, quiet, continuous operation at low cost. Over 100 Chicago Air Diffusion Systems have been specified or installed in Sewage Treatment Plants.

Other Chicago Sewage Equipment makes possible the most economical and efficient operation of the plant. Two Chicago Comminutors cut coarse sewage matter into small settleable solids without removal from the channel. One 10″ and two 8″ Chicago Vertical Open Shaft Non-Clog Pumps handle the raw sewage. Everything was done to provide the City of Fairfield with a Sewage Treatment Plant that would deliver a clear, sparkling effluent. Shellfish beds in Long Island Sound and the recreational aspects of the surrounding waters will not be contaminated.

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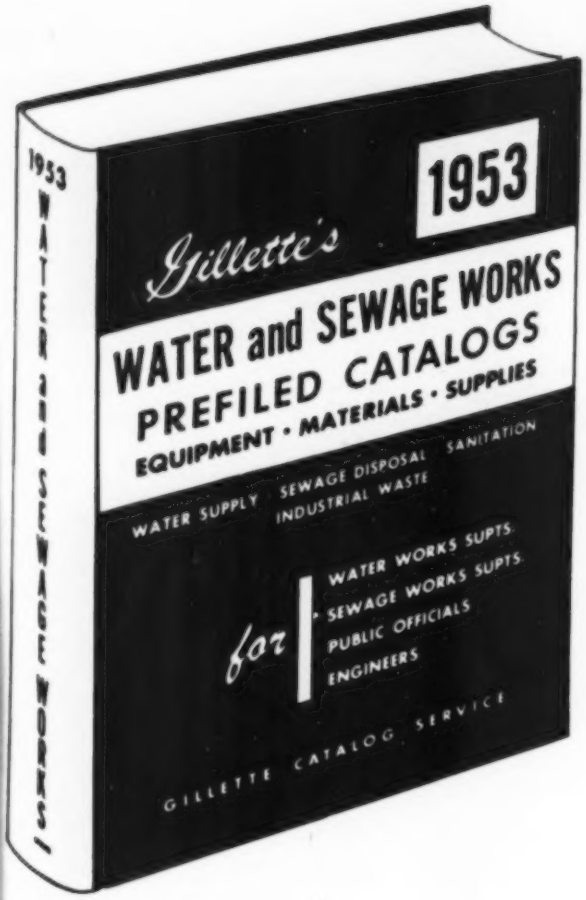

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"Nobody likes to kill," says Stanley Adams. "Nobody likes war. But today the surest way to invite a war is to be weak. You and I know that twice in the last ten years Americans have let their guard down. And the Philippine and Korean graveyards are filled with men who paid the price for it.

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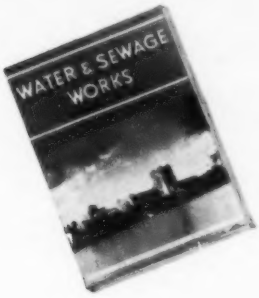

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Meetings Scheduled

Aug. 13—Machias, Maine
MAINE WATER UTILITIES ASSOCIATION. Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Aug. 18-22—Durham, N.C. *(Duke University)*
NORTH CAROLINA WATER WORKS OPERATORS' ASSOCIATION SHORT SCHOOL. Sec'y, Max D. Saunders, Supt. Water Plant, Univ. of North Carolina, Chapel Hill, N.C.

Aug. 24-27—Los Angeles, Calif. *(Shrine Convention Hall & Ambassador Hotel)* AMERICAN PUBLIC WORKS ASSOCIATION. (Congress & Equipment Show) Exec.-Dir., D. F. Herrick, 1313 East 60th St., Chicago 37, Ill.

Aug. 25-27—State College, Pa. *(Nittany Lion Inn)*
PENNSYLVANIA WATER WORKS OPERATORS ASSN. Sec'y, R. Rupert Kountz, Pennsylvania State College, State College, Pa.

Aug. 27-29—State College, Pa. *(Nittany Lion Inn)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 3-5—Upper Saranac, N.Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Rollo K. Blanchard, 50 West 50th St., New York, N.Y.

Sept. 8-10—Groton, Conn. *(Hotel Griswold)*
NEW ENGLAND WATER WORKS ASSOCIATION (Annual Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Sept. 3-13—Chicago, Ill. *(Conrad Hilton)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Centennial Celebration). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

Sept. 9-11—Grinnell, Iowa *(Grinnell College)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtkamp, Box 310, Webster City, Iowa.

Sept. 10-12—Sioux Falls, S.D. *(Hotel Cataract)*
MINNESOTA SECTION A.W.W.A. Sec'y, L. N. Thompson, Water Dept., St. Paul, Minn.

Sept. 15-17—Knoxville, Tenn. *(Andrew Johnson Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, R. P. Farrell, Dept. of Public Health, 420 6th Ave., Nashville, Tenn.

Sept. 15—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, C. E. Harness, 272 City & County Bldg., Denver, Colo.

Sept. 16-17—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, Box 600, Denver, Colo.

Sept. 16-18—Madison, Wis. *(Hotel Loraine)*
WISCONSIN SECTION A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison 3, Wis.

Sept. 17-19—Pierre, S. Dak. *(Hotel St. Charles)*
SOUTH DAKOTA WATER & SEWAGE WORKS CONFERENCE. Sec'y, Charles E. Carl, State Board of Health, Pierre, S.Dak.

Sept. 18-19—Cincinnati, Ohio *(Netherland Plaza Hotel)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, Ohio.

Sept. 21-23—Jefferson City, Mo. *(Governor Hotel)*
MISSOURI SECTION A.W.W.A. MISSOURI WATER & SEWAGE CONFERENCE. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

Sept. 24-26—Battle Creek, Mich. *(Post Tavern)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, Dept. of Health, Lansing 4, Mich.

Sept. 24-26—Atlanta, Ga. *(Georgia Institute of Technology)*
GEORGIA WATER & SEWAGE WORKS OPERATORS' SCHOOL. Sec'y, N. M. deJarnette, Dept. of Public Health, Atlanta, Ga.

(Continued on page 80A)

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Meetings Scheduled

(Continued from page 78A)

Sept. 25-27—Winnipeg, Man. *(Royal Alexandra Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. (1 day Operators' School, Sept. 24). Sec'y, F. M. White, 301 Hamilton Bldg., Winnipeg, Man.

Oct. 2-3—Parkersburg, W.Va. *(Chancellor Hotel)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, H. K. Gidley, State Dept. of Health, Charleston, W.Va.

Oct. 6-9—New York, N.Y. *(Statler Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS (Annual Meeting). Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill. (and) NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS. Sec'y, Ralph C. Sweeney, 21 N. Broadway, White Plains, N.Y.

Oct. 8—Bethel, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Oct. 12-15—Tulsa, Okla. *(Mayo Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 14-17—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 20-22—Pittsburgh, Pa. *(Wm. Penn Hotel)*
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA. Sec'y, William Porter, Wm. Penn Hotel, Pittsburgh 30, Pa.

Oct. 21-22—Fredericton, New Brunswick *(Lord Beaverbrook Hotel)*
MARITIME BRANCH, CANADIAN SECTION A.W.W.A. Sec'y, J. D. Kline, P. O. Box 574, Halifax, N.S.

Oct. 20-24—Cleveland, Ohio *(Public Auditorium)*
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Oct. 23-25—Atlantic City, N.J. *(Hotel Madison)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 23-24—Portland, Ore. *(Multnomah Hotel)*
PACIFIC NORTHWEST SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Robert O. Sylvester, More Hall, University of Washington, Seattle 5, Wash.

Oct. 23-25—Mason City, Iowa *(Hanford Hotel)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 28-31—Pasadena, Calif. *(Huntington Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, John C. Luthin, 1113 Laurant St., Santa Cruz, Calif.

Oct. 29-31—Washington, D.C. *(Wardman Park Hotel)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl L. Lauter, 6955 33rd St., Washington, D.C.

Nov. 3-5—Montebello, Quebec *(Seigniory Club)*
CANADIAN INSTITUTE OF SEWAGE & SANITATION. (Annual Meeting). Sec'y, Dr. A. E. Berry, Parliament Bldgs., Toronto, Ont.

Nov. 5-7—Old Point Comfort, Va. *(Chamberlin Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, Regional Engr., 708 State Office Bldg., Richmond, Va.

Nov. 10-12—Hendersonville, N.C. *(Hotel Skyland)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 16-19—Pensacola, Fla. *(Hotel San Carlos)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, C. W. White, State Board of Health, 519 Dexter Ave., Montgomery 4, Ala. (Joint Meeting).
FLORIDA SECTION A.W.W.A. Sec'y, M. R. Boyce, 504 Pennsylvania Ave., Clearwater, Fla.

Dec. 4-6—Havana, Cuba
CUBAN SECTION A.W.W.A. Sec'y, L. H. Daniel, Baratillo 9, Havana, Cuba.

Dec. 7-10—Cleveland, Ohio *(Hotel Cleveland)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting). Sec'y, F. J. Van Antwerpen, 120 East 41st St., New York 17, N.Y.

Dec. 10—Winthrop, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

New Waste Treatment Book By Besselievre of Dorr

"Industrial Waste Treatment," a new book by Edmund B. Besselievre, is planned as a guide to evaluate factors involved in arriving at a practical and economical solution to problems of stream pollution.

The author defines the waste problem, discusses the plant owner's responsibilities for solving it, and surveys, in detail, the jurisdiction of various agencies over the owner's actions. He describes available methods, equipment and devices for analyzing and solving industrial waste problems, and shows flow diagrams of treatment plants now in use, with accompanying photos of installations and units of equipment.

Among the important topics discussed are: (1) the need for mutual cooperation between enforcing agencies, the industrialist, and the consulting specialists he has called in; (2) the charges made by municipal systems for handling industrial wastes; (3) the formation of districts to handle the wastes of several factories in one treatment plant; (4) the possibilities for re-using wastes and their recovery values.

During the past 30 years, Mr. Besselievre's work in the U.S. and in 41 other countries and possessions has resulted in the completion of over 500 operating plants for sewage and industrial waste treatment. An authoritative lecturer and writer on the various phases of this involved problem, Mr. Besselievre also holds 4 patents on treatment devices of his own design. At present he is Chief Sanitary Engineer with the International Sales Division of The Dorr Company, Engineers.

"Industrial Waste Treatment" is a book of 365 pages published by McGraw-Hill Book Co. The price is $7.00.

Fluoridation Favored in Public Opinion Poll

A poll of public opinion conducted by the *Minneapolis Sunday Tribune* as a statewide survey indicates that 51 per cent of an adult cross-section indorse the use of fluorine in drinking

Why skilled workmen Choose RIDGID PIPE VISES

It's *Extra* easy to work with RIDGID Vises

★ All have handy integral pipe rests and benders.

★ Yokes and bases of strong special malleable; top quality tool-steel jaws—LonGrip jaws up to 6" capacity.

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★ Buy work-saver RIDGID vises at your Supply House.

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Work-Saver Pipe Tools

water, while 21 per cent are opposed. Six per cent gave qualified answers —mostly "favor if it had no bad taste" or "favor if it really helps" or "favor if it has no ill effects"—and 22 per cent are undecided.

People who know why the use of fluorine in drinking water has been proposed are more strongly in favor of the idea (64 per cent approve) than are those who have no information or who have incorrect beliefs about the purpose of fluorine in the water (43 per cent approve).

In the Minnesota Poll survey, interviewers asked first:

"Have you ever heard or read anything about the use of fluorine in drinking water?"

The answers:

	All	Men	Women
Yes	73%	73%	72%
No	25%	26%	25%
Don't recall	2%	1%	3%

Those answering "yes" then were asked:

"What is the purpose of putting fluorine in drinking water, as you understand it?"

Explanations in general terms like "helping to protect teeth against decay" were scored correct, and these were the results:

	All	Men	Women
Correct answers	51%	48%	53%
Vague and wrong answers	15%	19%	12%
Don't Know	7%	6%	7%
	73%	73%	72%
Haven't heard of fluorine	27%	27%	28%

Whether or not people in the sample had heard anything previously about fluorine, they were asked the following question:

"Some people are in favor of putting fluorine in drinking water supplies, because they say it helps to protect teeth against decay. Other people say they don't want fluorine in their drinking water. How do you feel about it—would you favor or oppose having fluorine put in your drinking water supply?

The replies:

	All	Had heard of fluorine	Had not heard of fluorine
Favor	51%	56%	35%
Oppose	21%	20%	26%
Qualified	6%	7%	5%
No opinion	22%	17%	34%

Sentiment in the Twin Cities area for fluorine use is somewhat less than it is elsewhere in Minnesota, judging from these replies:

	Minneapolis, St. Paul and suburbs	Rest of state
Favor	45%	54%
Oppose	23%	21%
Qualified	8%	5%
No opinion	24%	20%

ask the farmer's daughter!

When it comes to pumping water, farmers' daughters around the country could tell us a thing or two. To them pumping water means a lot of hard work at odd hours.

We can't come to the aid of the farmer's daughter but we can, through Centrilining, reduce pumping costs, increase carrying capacity and permanently eliminate corrosion and tuberculation from all pipelines 16" and larger.* That's why forward looking city engineers and officials are contacting us every day.

*Pipelines 4" to 14" are cement-lined by the Tate Process.

CEMENT-MORTAR LININGS FOR PIPES IN PLACE

2,298,688 FEET OF EXPERIENCE

CENTRILINE CORPORATION

A subsidiary of Raymond Concrete Pile Co.

140 CEDAR STREET, NEW YORK 6, N. Y.

Branch Offices in Principal Cities of United States and Latin America

ON THE WEST COAST, WRITE PIPE LININGS, INC., P. O. BOX 3428, TERMINAL ANNEX, LOS ANGELES, CALIFORNIA

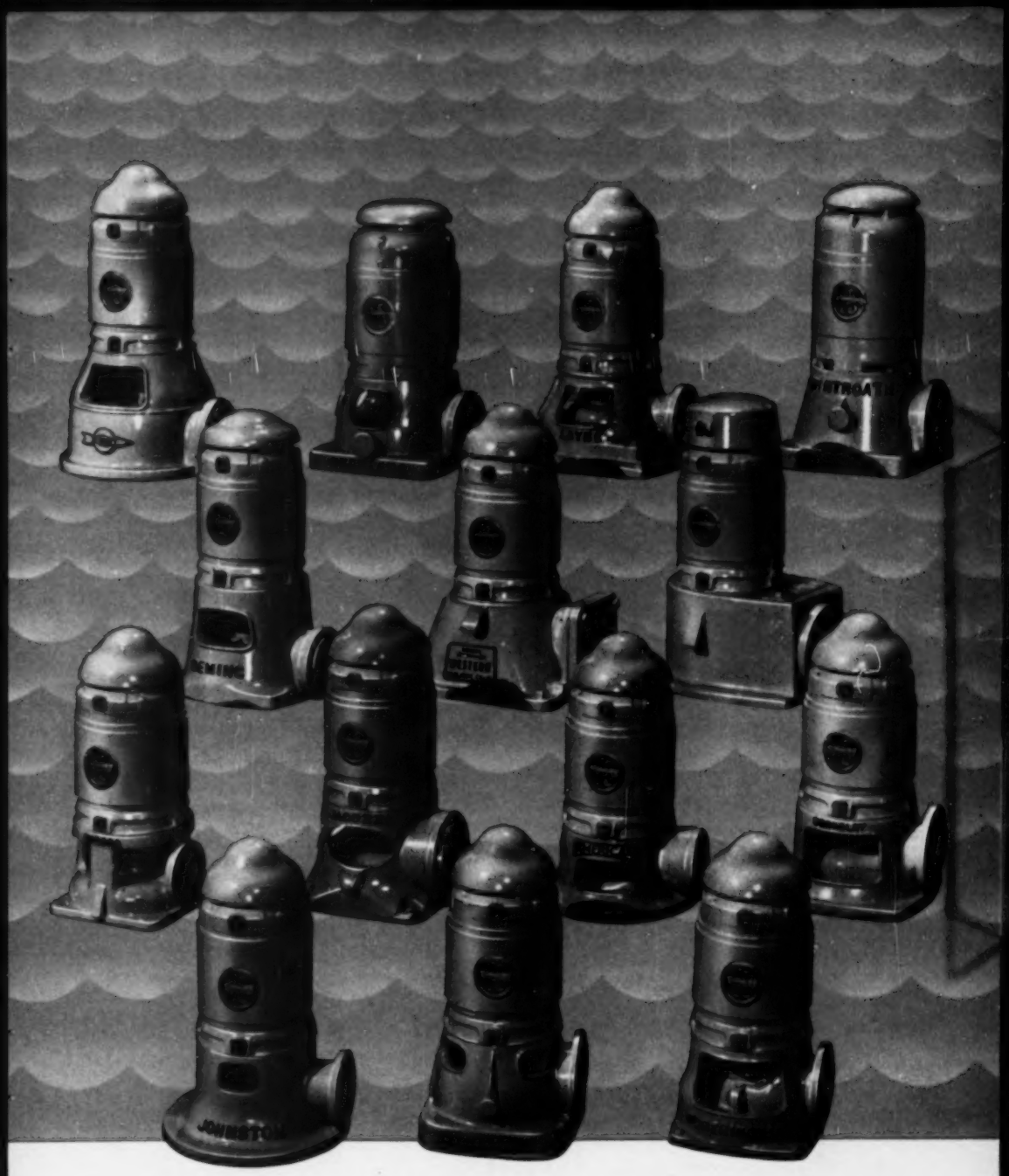
Foam, Froth or Suds from Detergents?*

During the Annual Conference of Illinois sewage treatment plant operators, a most interesting discussion arose during the session on "Sludge Digestion." The problem of modern detergents used in laundry and dishwashing water has caused excessive "foaming" or "sudsing" in aeration tanks, and has interfered with the operation of many of the Illinois plants. During the past few years many of the operators attending have complained of this and were seeking advice on how to stop it. This year we were told of the various tests which have been run in pilot plants using Tide as a detergent to create "foaming."

We learned that the first consideration is proper nomenclature, and because the term "foaming" heretofore meant "foaming" in digesters, the term "foaming" should not be used for this condition in aerators. The terms "sudsing" or "frothing" to de-

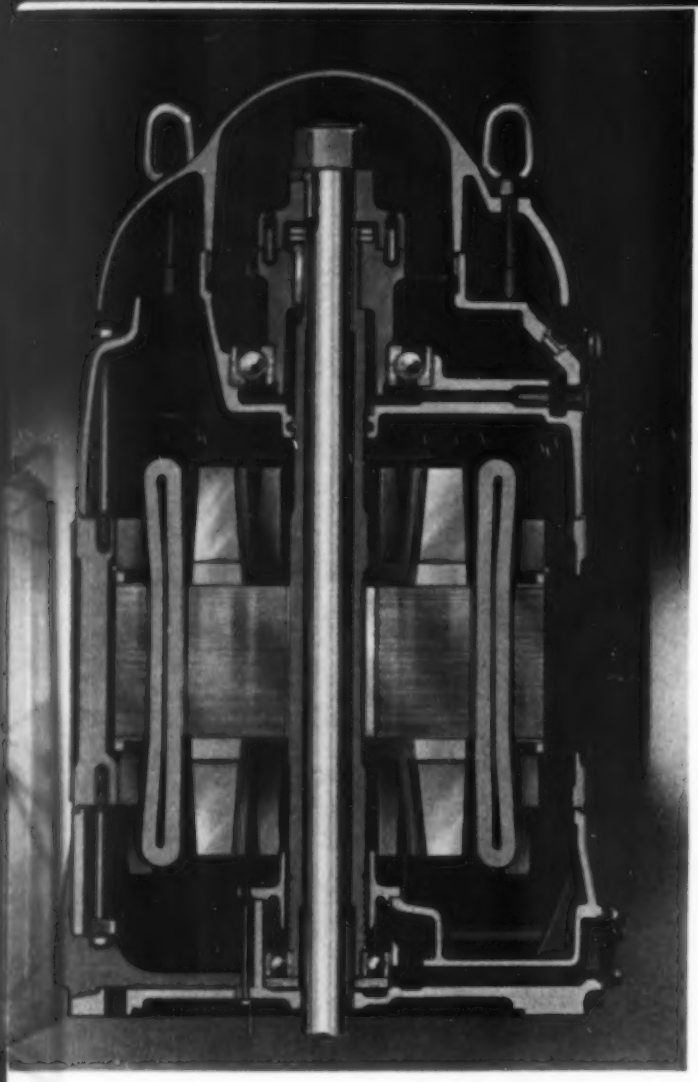
*This item is from the May 1952 issue of *The Digester*, published by the Illinois Dept. of Public Health, Div. of Sanitary Engineering.

(*Continued on page* 86A)



UNFAILING POWER FOR THE WORLD'S MOST FAMOUS PUMPS

U.S. VERTICLOSED MOTOR



U. S. VERTICLOSED MOTOR gives you these advanced features:

DOWNDRAFT VENTILATION

ASBESTOS-PROTECTED WINDINGS

NORMALIZED CASTINGS

REG-U-LUBE OIL FLOW

VIS-O-LUBE OIL GAUGES

LUBRIFLUSH LUBRICATION

ADJUSTABLE HOLLOWSHAFT

INTERCHANGEABLE BASES

PROTECTIVE HOUSING

STREAMWAY DESIGN

BALLOMATIC & VELVAGRIP BACKSTOPS
(OPTIONAL)

AMERICA'S MOST DYNAMIC PUMP MOTOR

U. S. Verticlosed Motor is the progressive result of designing power for a specific purpose—to economically power a vertical turbine pump. It has proved its stamina and unsurpassed dependability by performance measured not in years but in decades. Many U. S. Motors installed 30 to 40 years ago are still in service. Now, with numerous advanced features added, the endurance and dependability of the U.S. Verticlosed pump motor are more pronounced than ever. When making a pump motor replacement or when buying a new pump, specify U.S.

MAIL COUPON FOR DESCRIPTIVE BULLETIN

U. S. Electrical Motors Inc. Box 2058, Los Angeles 54, Calif. or Milford, Conn.
Send your new Bulletin illustrating and describing U. S. Verticlosed Motors

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U. S. ELECTRICAL MOTORS INC.
PACIFIC PLANT: Los Angeles 54, Calif. (Box 2058) ATLANTIC PLANT: Milford, Conn.
Sales offices in all principal cities. Consult Phone Directory.

US MOTORS

AMERICAN DOUBLE-X Mechanical Joint Pipe

"AMERICAN DOUBLE-X" is regular Mono-Cast centrifugal pipe equipped with the standardized mechanical joint for cast iron pipe. The AMERICAN DOUBLE-X joint is the original standardized mechanical joint which was put on the market in 1929. Manufactured under rigid specifications in diameters 3-inch through 48-inch, it is corrosion resistant, will stand the impact of heavy loads and gives complete job satisfaction. This pipe is manufactured in specific weights for specific laying conditions. You get the exact pipe your conditions require.

It is conveying water, manufactured, mixed and natural gas, crude oil, gasoline, sour naphtha, salt brine, Foamite fire foam, ashes—and in fact, just about everything that a pipe line can conceivably convey. It is conveying these products under operating pressures ranging from a few pounds to the square inch, up to pressures in excess of 100 pounds gas and 500 pounds liquid.

Being cast iron, AMERICAN DOUBLE-X pipe enjoys an enviable reputation. Cast iron pipe has had over 300 years of service abroad and more than 100 years of service in the United States. It is satisfactorily serving in locations where especially severe external and internal corrosion conditions exist.

A complete line of fittings for use with AMERICAN DOUBLE-X pipe is available including transition pieces for inter-connecting with other types of joints and pipe.

Branch stocks of both pipe and fittings are strategically located for your convenience.

Write for AMERICAN DOUBLE-X pipe and fittings booklet. A free copy will be sent on request.

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

Dallas	**Houston**	**El Paso**	**Pittsburgh**	**Kansas City**	**New York City**
Chicago	**Minneapolis**	**Cleveland**	**Los Angeles**	**San Francisco**	**Seattle**

(Continued from page 82A)

scribe this condition were arbitrarily used: The plant in which these tests for control were performed is in Texas and it was found that the ability to suds or froth is directly proportional to the solids content of the sewage. The tests showed conclusively that when 1300 p.p.m. of solids were carried in the aeration tanks, sudsing or frothing was completely stopped and below this solids content this sudsing or frothing appeared.

Some of the operators stated that in their own plants, with the type of sewage being treated, there were various amounts of solids content which would prevent sudsing or frothing and these amounts varied from 800 to 1000 p.p.m. It appears from the discussion that this method of control would not be satisfactory for many of our small sewage treatment plants which are mechanically operated. The rate of air presently supplied by the aerator is a set amount which can neither be increased nor decreased.

This amount of air will care only for a definite solids content in the aeration tank, and if the solids is increased without the air being increased proportionately, bulking will occur. While this method of suds control may work in some plants it will definitely throw other plants out of operation. However, it would be well for each operator who encounters this sudsing problem to experiment in his own plant to determine whether or not the solids content can be placed at the proper amount to eliminate sudsing and yet furnish enough air to satisfactorily operate the plant.

Circular Collectors

Types for every waste treatment problem

- DESIGNED FOR EFFICIENT LONG-TERM OPERATION
- ENGINEERED FOR USE IN CIRCULAR OR SQUARE TANKS
- SELECTION OF DRIVES TO MEET YOUR SPECIFICATIONS
- CLARIFLOW THICKENERS FOR FLUE DUST CLARIFICATION

TRACTOR DRIVE COLLECTOR

This pier-supported collector is designed for circular tanks. The rotating bridge acts as the lever arm rotating a sturdy center cage which carries the collector arms. Rotational force is provided by a two-wheeled, rubber tired tractor unit running on the rim (or effluent weir wall of the tank). Drive unit is simple, easily accessible, and not affected by snow or ice.

SUSPENDED COLLECTORS are used where a simple bridge can span the tank diameter. In this case, the complete motor and drive assembly, together with the drive tube and collector arms, are suspended from the bridge.

WRITE FOR BULLETIN 9W65

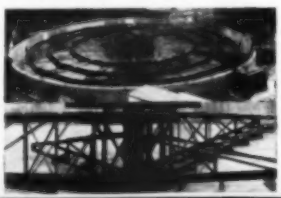
PIER DRIVE COLLECTOR

The Pier Drive Collector is recommended where it is undesirable to operate a Tractor Drive . . . where the access bridge must be stationary, or the corners of square tanks must be scraped. Center drive mechanisms, ranging from 1/2 to 10 horsepower, are built for long life and heavy duty service. Worms are carburized and ground steel and precision meshed with hardened bronze worm wheels. The balls run in hardened, ground, renewable ball races.

CLARIFLOW THICKENER

This unit utilizes the principles of fluid mechanics, so highly developed in Walker sedimentation units. It removes all settleable solids and remarkably clarifies the flow. All parts are sturdily built . . . designed for the "tough" jobs.

WRITE FOR BULLETIN 10169



PROQUIP PROCESS EQUIPMENT

WALKER PROCESS EQUIPMENT INC.

FACTORY • ENGINEERING OFFICES • LABORATORIES

AURORA, ILLINOIS

AMERICA'S greatest supply of fresh, soft, low-cost

WATER FOR INDUSTRY

with electric power reserves at

CHARLESTON, S.C.

For specific data:
Write Arthur M. Field, Chief Engineer, CHARLESTON DEVELOPMENT BOARD

Water-a-Plenty!

This is the sort of advertising that delights our heart.

Fortunate, foresighted, Charleston is in position to advertise to the world that it has an ample supply of fresh, soft, low-cost water for as many industries as may wish to locate there.

Ads, such as that here reproduced, are being run by the Charleston Development Board in all important northern newspapers. Charleston has the water in quantity and quality and is now capitalizing on this great asset. And, it *is* a great asset.

International Nickel Presents Color Film on Corrosion

International Nickel Company, Inc., New York, N.Y., has announced the completion of a three-part sound color film showing corrosion in action as well as how its attacks can be avoided or controlled.

The film entitled "Corrosion in Action," made in three parts of two reels each, shows how corrosion works to cause an annual loss in industry and elsewhere estimated at over six billion

(Continued on page 88A)

Carlon Water Service Pipe

Now . . . CARLON "WS" corrosionproof plastic pipe offers new advantages for municipal water system service connections. It is easier to handle, faster to install and lasts longer than any metallic pipe.

CARLON weighs only 1/8th as much as steel pipe — requires no rigging equipment. Being flexible, it can be curved to follow irregular contours or ditch lines. It is furnished in long lengths which require fewer fittings, and fitting make-up can be done in a matter of minutes. Special connecting fittings for corporation stops and meter yokes are available.

CARLON ends costly periodic replacement of water lines because of electrolytic corrosion or interior build-up. It is the only pipe that is guaranteed against rot, rust and electrolytic corrosion! Smooth internal wall will not accumulate scale or sediment — assures permanent free-flow.

Complete line of molded plastic fittings makes possible all-plastic installations and facilitates connection of CARLON "WS" pipe to previously installed metallic systems.

Nominal Pipe Size	O.D.	I.D.	Working Pressures P.S.I. @ 120°F.	Weight Per Foot	Normal Shipping Lengths
3/4"	1.170	.824	120	.216	400' coils
1"	1.433	1.070	120	.285	300' "
1 1/4"	1.850	1.380	120	.477	300' "
1 1/2"	2.260	1.610	120	.790	250' "
2"	3.000	2.070	120	1.88	200' "
2"	2.495	2.070	75	.620	200' "
2 1/2"	2.950	2.470	75	.820	150' "
3"	3.670	3.070	75	1.280	100' "
4"	4.820	4.030	75	2.200	25' straight
6"	7.260	6.070	75	5.000	25' "

Write today for literature.

CARLON PRODUCTS CORPORATION

In Canada: MICRO PLASTICS, Ltd., Acton, Ontario

10300 MEECH AVENUE • CLEVELAND 5, OHIO

(Continued from page 86A)

dollars. It also shows how this damage can be avoided or controlled by various means, such as by the selection of corrosion-resistant materials, by the development of new alloys to meet given situations, by the use of electric currents to provide cathodic protection, and by other methods.

"Corrosion in Action" has been so produced that it can be shown in one part, in any combination of two parts, or in the full three-part length, depending upon the time available. Each part requires 20 minutes showing time. In producing it, films were made at the big testing stations of the Kure Beach corrosion testing project, near Wilmington, N. C.; at the new laboratory at Harbor Island, N.C.; and in industrial plants in various parts of the country. Association program committees should be interested in this educational film for showings at meetings.

Excerpts from Purdue's Sanitary Engineering News

Edited by Prof. Don E. Bloodgood

From a recent program the title "Industrial Wastes—*A Wormseye View*"—This leads one to wonder whether the author might not resent the title?

Ed. Note—For the answer see this unusual article by Hedgepeth in our Sept. 1951 issue.

200,000 gallons of water are required to manufacture a ton of rayon.

Carbon dioxide and oxygen dissolved in steam are the principal causes of steam and condensate line corrosion.

Charles Wallace & Martin Tiernan began tinkering with water purification equipment forty years ago—*thank goodness.*

Have you seen the new Bulletin put out by the Indiana State Board of Health on garbage disposal? This is worth writing for.

The lagoons for digesting raw sludge at Houston, Texas, have been rated at 100 tons of dry solids per acre foot per year.

M-H TRAFFIC MODEL FIRE HYDRANTS

M & H Traffic Model Fire Hydrant is designed with a breakable coupling and breakable bolts at the ground line. In the event of traffic accident, the breakable parts separate without damage to other parts of the hydrant. Repair costs are negligible, quickly and easily done with another breakable coupling and eight breakable bolts. This repair work can be done without shutting off the water. M & H Traffic model is similar in design to M & H standard A. W. W. A. hydrant, and parts are interchangeable. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.

OTHER MODELS

(1) A. W. W. A. standard (2) Mill Yard or "I. G. N." (3) Approved and listed by Underwriters' Laboratories and Associated Factory Mutual Laboratories. (4) Flush type fire hydrants which set completely underground.

For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

— TERRITORIES OPEN —

WANTED

MANUFACTURERS' AGENTS TO CONTACT GAS UTILITIES AND MUNICIPALITIES

Sell one of the outstanding names in the waterworks and gas utility field. In taking on the McDonald line you will receive help from our merchandising and advertising campaigns. Our line and the product need no introduction. Investigate the opportunity of adding this profitable and well known product to your regular line.

A. Y. McDONALD MFG. CO.
Dubuque, Iowa
ATTENTION: A. Y. McDonald, Secretary

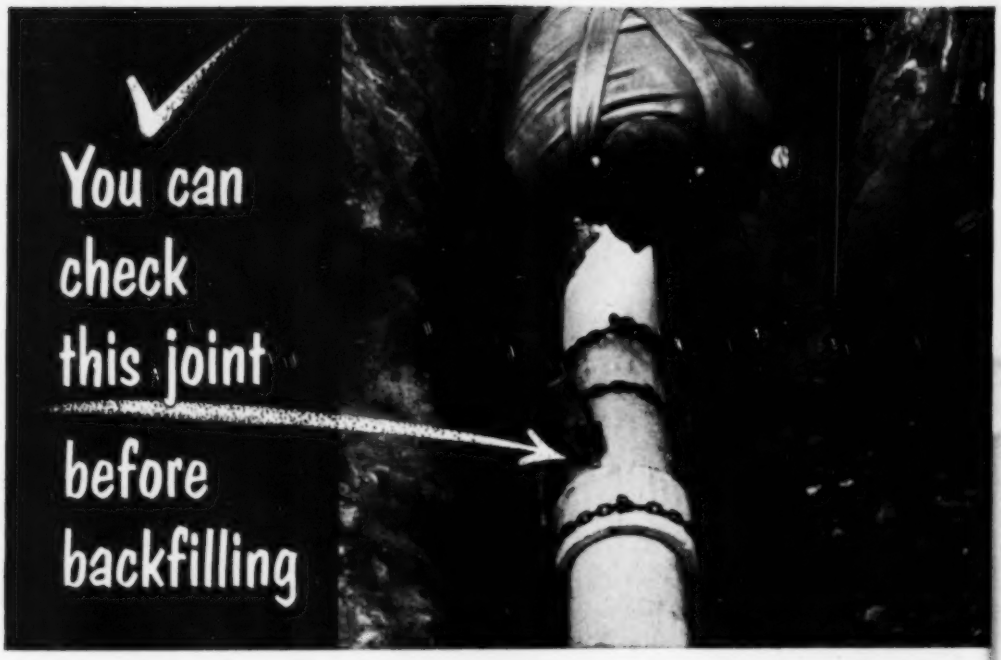
POSITION WANTED
as water department manager

Twenty years' experience as assistant superintendent Department of Water and superintendent of maintenance. Also have own water main cleaning equipment.

Reply

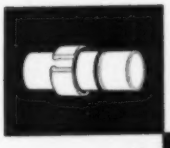
Box 262 **Columbus, Ohio**

WANTED: Sales Representative, to sell outstanding water treating system to industrials and municipalities. Outstanding advantages over existing systems at lower cost. Exclusive franchise to qualified men. Write giving full experience and our proposition. Box 1087, Water & Sewage Works, 22 W. Maple Street, Chicago 10, Illinois.

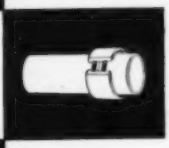


. . . it's the *tight* RING-TITE JOINT used with TRANSITE SEWER PIPE

HERE'S HOW THE RING-TITE JOINT WORKS:



Start of assembly. Two rubber rings and a Transite sleeve (cut away to show position of the rings) are placed on one of the two pipe ends to be joined.



Final position. Sleeve centered over both pipe ends, with the rubber rings tightly compressed between sleeve and pipe.

Checking joint for proper assembly. This is done with a simple gauge immediately after the joint is made . . . *before backfilling.*

*Transite is a registered Johns-Manville trade mark

NOT ONLY IS IT POSSIBLE to assemble the new Ring-Tite Coupling in a fraction of the time required for making ordinary sewer pipe joints—but, with the use of a simple feeler gauge, you can check this joint for proper assembly as soon as it is made, *and backfill immediately!*

This "packaged" joint—furnished with Transite* Pipe and ready for assembly—has still other important practical advantages. Not only are there fewer joints to make due to long thirteen-foot lengths, but time is saved also by eliminating the use of poured compounds. Just a simple assembly operation with a mechanical coupling puller, and the Ring-Tite Joint is ready for service.

Its tightness means less infiltration in the sewerage system and this effects savings in treatment costs. Transite's high-flow capacity (Manning's n = .010) often results in substantial installation savings by permitting flatter grades and shallower trenches – an important economy where pipe is laid at or below the ground water table or in rock excavation.

For further data about this corrosion-resistant asbestos-cement pipe and how it can save money for you, write for Folder TR-103A. Address your inquiry to Johns-Manville, Box 60, New York 16, N. Y.

JM PRODUCTS **Johns-Manville TRANSITE SEWER PIPE**

The spent broth from penicillin manufacture has a solids content of about 20,000 ppm and a B.O.D. of 7,500 ppm. It consists primarily of proteins, sugars & organic acids.

Stream pollution that had been going on continuously for 40 years was stopped six days after the State of Ohio brought suit against the violators.

Ralph Spurgeon (Ligonier) uses a basketball to aid in sewer cleaning. Perhaps some of the notorious teams have become contaminated when their equipment was so used.

Have you tried using the unbreakable polyethylene bottles to eliminate alkali from stored standard solutions.

Activated returned sludge and mixed liquor have been found to settle more rapidly after exposure to ultrasonic vibrations.

We have one of the new magnetic stirring devices in our laboratory. It is a neat device. Have you seen one?

F. L. Woodward, Chief of Minnesota's Environmental Sanitation Section, says the excessive nitrates in water come from glacial drift. Linn Enslow and some of the rest of us want to know how the nitrates get into the glacial drift.

A committee is working on the standardization of letter symbols used in hydraulic formulae. Too much standardization is not good but I do approve of this particular undertaking.

The Green Bay, Wisconsin, treatment plant is one of the few that is completely housed.

"I NEVER CONNECT IN THE WRONG HOLE- with FLEXICROME SEWER-ROD COUPLINGS!"

Pats. 2,110,202 2,471,060

Greatest Improvement Since the Coupling Itself!

This improved coupling for HIGH SPEED POWER TURNING MACHINES never assembles in the wrong (lock pin) hole, making it necessary to uncouple to use a lock pin. Saves time and money. CLICK, SNAP — IT'S HOME. "FLEXICROME" ROD —made exclusively for Flexible — is used exclusively. They are interchangeable with all "OLD STYLE" Flexible Rods.

"OLD STYLE" Rods and Couplings can still be furnished to cities that still turn their rods by hand (the slow, expensive way). Expect as good results as you had 15 YEARS AGO.

Just move coupling in or out of the ratchet or power drive shaft—pressing pin down till it clicks. Then turn right or left for hole.

WRITE today

"FLEXIBLE"
SEWER-ROD EQUIPMENT CO.
9033 VENICE BOULEVARD, LOS ANGELES 34, CALIF.

41 Greenway St. — Hamden 14, Conn.
147 Hillside Terrace — Irvington, N. J.
P. O. Box 465 — Memphis, Tennessee
1115 Delaware Ave. — Fort Pierce, Fla.
141 W. Jackson Blvd. — Chicago, Ill.
200 Magee Bldg. — Pittsburgh, Penn.
66 Kinsley Drive — Rochester 9, New York
29 Cordon Avenue — Roslindale 31, Mass.
801 E. Excelsior Blvd. — Hopkins, Minn.
3786 Durango St. — Los Angeles 34, Calif.
6455 S. E. 24th Street — Portland, Oregon
Francis Hankin — Montreal & Toronto, Can.
351 West Jefferson Blvd. — Dallas, Texas

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

Manufacturers & Equipment News

"ENZYMATIC"

Something New Added in Sewage Treatment; Marked Benefits Reported.

701

An entirely new biological method of sewage treatment, which greatly accelerates digestion by means of enzymatic action and is claimed to alleviate many problems of sewage disposal plants, is attracting considerable attention as enthusiastic test reports come in from various parts of the country.

The new product, called "Enzymatic," is a powder which combines over 70 different types of enzymes.

(*Continued on page 92A*)

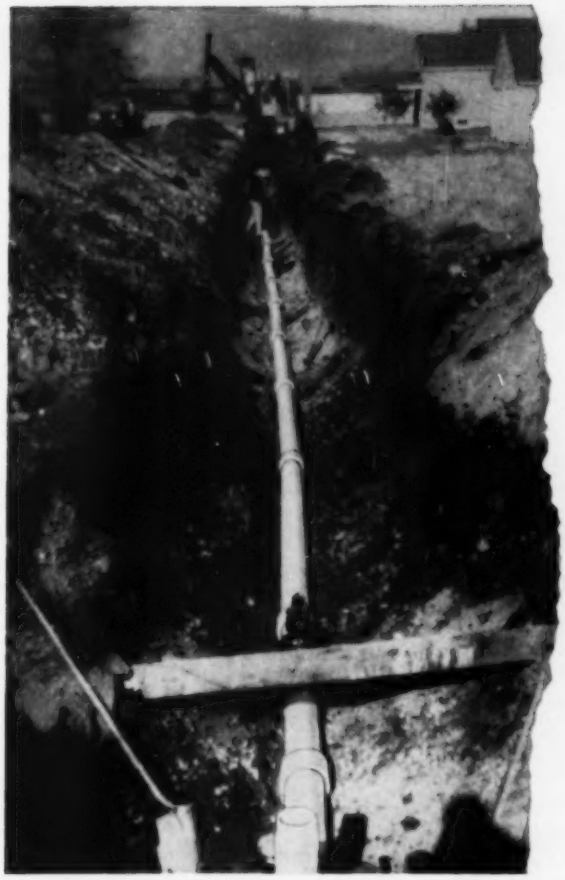
"Since 1885"

Sewage and Garbage Shredders

Detailed Specifications and suggested Installation Drawings furnished

GRUENDLER
CRUSHER & PULVERIZER CO.
ST. LOUIS 6, MO.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.



as the trench is dug... "CENTURY" asbestos-cement pipe makes quick work of the main job!

When "Century" Asbestos-Cement Pipe is employed, its installation follows smoothly, economically, and quickly along the trench dug by fast modern machinery...as is shown in the picture above.

Put yourself in that trench; "see" how quickly and easily a "Century" water main is installed: it is light in weight, yet because of its inherent strength it needs no coddling. Notice how "Century" Simplex Couplings save hours of trouble as the laying crew keeps up with the trenching machine; curves up to 5° deflection per pipe length are taken easily, special bends are held to a minimum, and flexural strains due to settlement or trench loading are minimized by the flexible couplings.

Now place yourself in the position of an engineer reviewing this job years later. The "Century" Asbestos-Cement Pipe still has the same carrying capacity—because it never tuberculates, rusts or corrodes, its smooth inner surface is permanent. Outwardly it is intact due to its high resistance to the destructive effects of soils. The "Century" Simplex Couplings, though still flexible have become a permanent part of the line. In fact "Century" Asbestos-Cement Pipe actually increases in strength over the years. Therefore if occasion arises it can be re-used at its original classification.

On your next water main specify readily justified "Century" Asbestos-Cement Pipe. Its moderate cost . . . its short, labor-saving installation time . . . and its long, trouble-free, water-carrying life . . . make it the taxpayer's "write-in" favorite!

Write for FREE BOOKLET, "Mains without Maintenance." Gives valuable data, specifications, and reference material for anyone interested in water main pipes.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

(Continued from page 90A)

Each reacts on a specific kind of organic element in sewage. Together they produce an effect so potent that, if sufficient time is given, a single pound of Enzymatic will reduce as much as 700,000 lbs. of organic matter from solid to liquid state. This is based upon U.S.P. Standards and other accepted methods of determining ratios of enzyme activity compared with the actual quantities of active enzymes in Enzymatic.

Since bacteria which digest sewage are closed cells and cannot absorb solids, the normal rate of digestion has always been slow, even with the application of heat to the digester. As long ago as 1930, U.S. Government researchers suggested the use of enzymes to speed up the digestion process, but until now the cost has been prohibitive.

Today, by adding small quantities of Enzymatic to the digester (1 lb. to each 1000 cu. ft. of contents) solids can be broken down into liquids far more rapidly than ever before. Thus the bacteria can absorb and digest the sewage solids much faster.

In addition, the following important benefits are also claimed for Enzymatic:

Odor is greatly reduced or completely eliminated, since complete digestion is now possible before the sludge is drawn off, and thoroughly digested sludge gives off little or no odor. *The amount of sludge is reduced up to 30%.* Moreover, it is rendered so thin and liquid that it flows like water. In addition, sludge from Enzymatic-treated digesters or Imboff tanks dries in weeks compared to months. *Gas formation is increased,* and a constant supply is assured because ample liquid food is always available for complete digestion.

Fats are liquefied as easily as proteins and starches, thus permitting thorough digestion of fats never before possible. It is the 10% fats found in normal sewage which form the bulk of the scum on digester and gas chambers, clogs spray nozzles and retards sludge drying. By liquefying this fat, Enzymatic automatically cleans spray nozzles and permits sludge to dry in two weeks instead of the three to four months frequently required.

According to the distributors hundreds of enthusiastic reports have been received from sanitation officials and plant operators who have tested Enzymatic for one or another benefit.

The N. O. Nelson Company, P. O. Box 3265, St. Louis 10, Mo., are distributors for Enzymatic. This organization has had 76 years experience in the sanitation business. Address them (Dept. "HH") for additional data and reports from those who have found "Enzymatic" beneficial. We understand that Enzymatic is sold with a performance guarantee that it will measure up to all the claims made for it.

how Kewaunee Research aids *your* Research

For nearly half a century Kewaunee has devoted its energies to designing, engineering and manufacturing the very finest wood and metal laboratory equipment and casework.

This has involved constant research at Kewaunee—in functional design, in materials improvement, in product development, in manufacturing processes. Research that has brought you such outstanding developments as Kemtherm sinks, KemROCK work surfaces, unit assembly, flexibility of arrangement, and many modern, work-saving features.

Such developments insure maximum working convenience, materially aid your own research activities, inspire your technicians, and speed up laboratory work.

Depend on Kewaunee to continue bringing you *through* research, the finest laboratory equipment—*for* research.

Manufacturers of wood and metal laboratory equipment

Representatives in principal cities

Kewaunee Mfg. Co.

J. A. Campbell, President

5102 S. Center St. Adrian, Michigan

O. A. Smith Appoints Cain New Orleans Representative

A. O. Smith Corp., Milwaukee, Wis., has announced the appointment of Will Cain as New Orleans sales representative. Mr. Cain, a 1948 graduate of the University of Texas, previously was a sales engineer on A. O. Smith's Houston Staff.

The New Orleans office is at 538 International Trade Mart. Mr. Cain will handle process equipment, line pipe casing, industrial grating and vertical pumps in Southern Louisiana.

Magnuson Joins Labline as Director of Research

Labline, Inc., Chicago, Ill., has announced the appointment of Donald V. Magnuson, formerly manager of Research at Precision Scientific Company for over four years, as Director of Research and Development for Labline, Inc.

Mr. Magnuson is a graduate of Armour College of Engineering and

(Continued on page 94A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

IN BUILDING SEWERS FOR THE YEAR 2000 TAMPA, FLORIDA CHOOSES *CONCRETE PIPE*

To eliminate dangerous and obnoxious pollution in the Hillsborough River and adjacent bay waters, Tampa, Fla. built an extensive new sewage system. Planned for the future, the system is designed to serve an expanding metropolitan area population that is expected to reach 335,000 by the year 2000, nearly triple Tampa's present population.

The new facilities include intercepting sewers, pumping stations, force mains, lateral sewer extensions, six crossings beneath river and harbor channels, a sewage treatment plant with a 36 mgd primary treatment capacity and a subaqueous outfall.

This huge system was built by several contractors. Greeley and Hansen of Chicago were the engineers for the entire project. Sizes and quantities of concrete pipe used are listed below.

Like Tampa, hundreds of other American cities have selected concrete pipe for dependable, economical sewer service. In many of these cities concrete pipe sewers have rendered ***low-annual-cost*** service for 70, 80, 100 years and more.

Concrete pipe has solved numerous difficult sewer problems because it has (1) the strength to withstand severe impact and to sustain heavy overburdens, (2) the smooth interior surface to resist abrasion and provide maximum hydraulic capacity and (3) the uniformly dense structure and tight joints to insure minimum infiltration and leakage.

Because concrete pipe is moderate in first cost, requires little or no maintenance and lasts so long, it delivers ***low-annual-cost*** sewer service. That is appreciated by civic officials and taxpayers alike.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

48 in. concrete pipe being lowered for channel crossing

CONCRETE PIPE USED IN TAMPA SEWERS

13,500 ft.	60 in.	2,400 ft.	42 in.
16,300 ft.	54 in.	2,800 ft.	36 in.
21,000 ft.	48 in.	13,400 ft.	30 in.
2,900 ft.	27 in.		

CONCRETE PIPE IN SUBAQUEOUS OUTFALL

3,750 ft. 78 in.

CONCRETE PIPE IN RIVER AND CHANNEL CROSSINGS

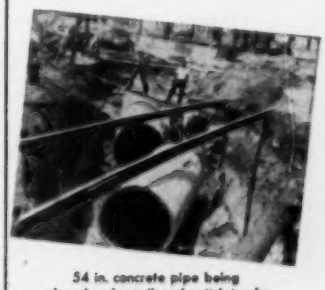
1,475 ft.	48 in.	320 ft.	36 in.

CONCRETE PIPE IN FORCE MAINS

9,100 ft.	54 in.	250 ft.	48 in.
3,900 ft.	30 in.		

CONCRETE PIPE IN TREATMENT PLANT

1,650 ft.	84 in.	200 ft.	72 in.
215 ft.	54 in.		



54 in. concrete pipe being placed under railroad switch tracks

(Continued from page 92A)

Physical Chemistry and Electronic Engineering.

Hydraulic Dump Truck Body Hoists

702

St. Paul Hydraulic Hoist, Minneapolis, Minn., has announced a complete new line of hydraulic dump truck body hoists and bodies featuring many outstanding design improvements.

St. Paul claims "more payload per dollar" in the new line because of greater payload capacities per dollar cost . . . up to 22% more payload than previous models. Fourteen models of this new hoist are available in a selection of capacities from 6 to 25 tons.

Welsh Promoted by Hall Laboratories

Hall Laboratories, Inc., Pittsburgh, Pa., has announced that John N. (Jack) Welsh, associate director, will now handle all service contracts and other business activities of the firm of engineering consultants on boiler-water conditioning, process and waste water problems.

Mr. Welsh served as director of engineering service from 1939 to 1950, when he became associate director of Hall Laboratories.

He joined Hall in 1929, after receiving his B.S. degree in chemistry at Carnegie Institute of Technology. In his early work he served as a far-ranging service representative on industrial and boiler water problems, his virtually unlimited territory including the United States, Canada, Mexico and the Caribbean.

USE UNTRAINED LABOR

McWANE-PACIFIC *Boltite* PIPE

One man can assemble and make up Boltite mechanical joints. He needs no special skill or training. He needs only one tool—a ratchet wrench. All he does is socket the spigot in the bell, slip the gasket into the stuffing box thus formed, then tighten the bolts of the follower-ring or gland. This simple procedure in joint making saves time, saves labor, saves money.

Boltite is an ideal mechanical joint for water or gas, steam, oil, chemicals or other liquids. Gaskets are furnished of materials to suit the service required. Boltite joint parts are interchangeable with any make of Standardized Mechanical Joint for Cast Iron Pipe. For further details, write

McWANE Cast Iron Pipe Company
Birmingham, Ala.
Pipe Sizes 2" thru 12"

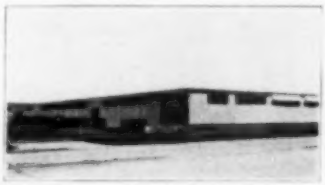
Sales Offices

Birmingham 2, Ala.	P. O. Box 2601
Chicago 1, Ill.	333 North Michigan Ave.
New York 4, N. Y.	80 Broad Street
Kansas City 6, Mo.	1006 Grand Avenue
Dallas, Texas	1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

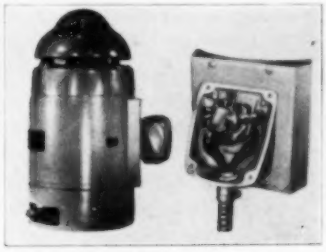
Provo, Utah	P. O. Box 18
Denver 2, Colo.	1921 Blake Street
Los Angeles 48, Cal.	6399 Wilshire Blvd.
San Francisco 4, Cal.	235 Montgomery St.
Portland 4, Oreg.	501 Portland Trust Bldg.
Salt Lake City	Waterworks Equip't Co.



McDonald of Dubuque Opens New Texas Branch

A. Y. McDonald Mfg. Co., Dubuque, Iowa, manufacturers of brass goods, has announced the opening of a new branch in Dallas, Texas. The opening of this building comes a year after McDonald began operations in this area to serve Texas and surrounding states.

Featured as a part of the building and grounds are a large parking area for automobiles and trucks, loading and unloading docks for handling all types of trucks and a railroad siding running to the building. Approximately 130,000 square feet of adjoining land will house future additions to the present building.



Single Phase Vertical Hollowshaft Motors

703

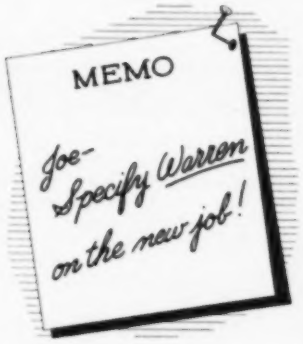
U. S. Electrical Motors, Inc., Los Angeles, Calif., has announced the addition of a series of single phase hollowshaft motors to their vertical motor line.

According to the company, an improved and simpler method of disconnecting the starting capacitors has been introduced into this line of motors—namely, the accelerating type

(Continued on page 96A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

When you specify WARREN Cast Iron Pipe...



You're Right!

WARREN Cast Iron Pipe is available in all sizes from 2" to 84" . . . with all types of joints . . . special fittings in numerous non-standard patterns to help you meet unusual requirements.

You're Right!

WARREN Cast Iron Pipe combines all of the qualities necessary to assure long-life, trouble-free service, toughness and strength. Proper crushing, beam, shock and bursting strength have always distinguished WARREN Cast Iron Pipe.

Warren FOUNDRY & PIPE CORP.
55 LIBERTY STREET, NEW YORK 5, N. Y.

Bell & Spigot Pipe • Flange Pipe • Mechanical Joint Pipe
Flexible Joint Pipe • Short Body Bell & Spigot Specials

WARREN PIPE CO. OF MASS. INC. 75 FEDERAL ST. BOSTON, MASS.
96 Years of Continuous Service

THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. P. O. BOX 14
MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks—
Nation Wide Service—33 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for three years, repairs guaranteed for ten years, provided the tank is painted every three years by Dixie Tank and Bridge Company, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

Dixie's Nation Wide Service Satisfies

COPYRIGHT 1951

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

(Continued from page 94A)

relay. Formerly a centrifugal switch, with its many moving parts and critical adjustment, was used.

Available from 1½ to 5 hp with speeds of 1800 or 3600 rpm, these motors were designed to provide maximum performance with positive relay operation over the widest variation in line voltage.

Worthington Names Carter, Karassik and Garnar Managers of Centrifugal Pump Section

Worthington Corporation, Harrison, N.J., has announced that newly-created managerial positions in the Volute Pump Section, Process Pump Section and Multi-Stage Pump Section of the Centrifugal Pump Division have been filled.

Roy Carter has been appointed manager of the Volute Pump Section. After obtaining his A.B. and M.E. degrees from Columbia University he joined the engineering department of the Worthington organization in 1923. He has been with the Centrifugal Pump Division since 1932.

L. H. Garnar has been appointed manager of the Process Pump Section. A graduate of Rensselaer Polytechnic Institute with an M. E. degree, Garnar joined the Centrifugal Pump Division in 1930.

I. J. Karassik has been appointed manager of the Multi-Stage Pump Section. A graduate of Carnegie Institute of Technology with the degrees of B.S. and M.S., he has been with the Worthington organization since 1934 and the Centrifugal Pump Division since 1935.

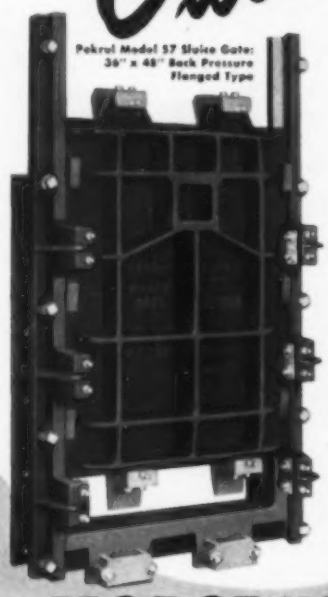
Karassik and Carter are well known for their several contributions to *Water and Sewage Works*.

Charles Werner is Dead

Mr. Charles Werner died suddenly at his home in New Jersey on May 22, 1952. He would have been sixty years old on June 22nd.

Mr. Werner was an outside erecting engineer for Roberts Filter Manufacturing Co., Darby, Pa., and had completed 30 years of service with this company in January, 1952. He is survived by his widow and three children by a former marriage.

Pekrul Gates



Pekrul Model 57 Sluice Gate: 36" x 48" Back Pressure Flanged Type

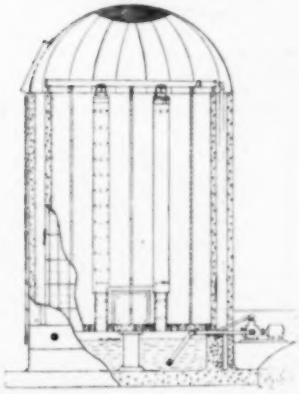
PEKRUL GATES are engineered to meet the most rigid requirements for:

Flood Control
Levees
Irrigation
Water Works
Dams
Sewage Disposal
Reservoirs
Pumping Plants
Oil Refineries
Fish Hatcheries
Rearing Ponds
Recreation Pools
Cooling Towers
Steel Mills

PEKRUL GATE DIVISION

MORSE BROS. MACHINERY
DENVER, COLORADO

Write for Catalog 49



Garbage Disposal by Composting and Land Enrichment

Said to Yield Worthwhile Profits.

704

A new system of garbage disposal, which is said to be odorless and sanitary, is also claimed to actually yield real profits from the sale of compost produced from the garbage.

Essentially the garbage is handled as farm ensilage would be on a small land plot on the outskirts of the community. Here the composter or battery of composters are constructed. These composters (aerobic digesters) are built like silos—one silo shell within the other as revealed in the accompanying sketch.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

It's New!

- it's different
- it's an "all-use" vinyl primer
- it virtually eliminates surface preparation
- it brushes easily — sprays beautifully
- it dries hard in minutes
- it provides excellent adhesion
- it goes under any type finish

it's TYGORUST

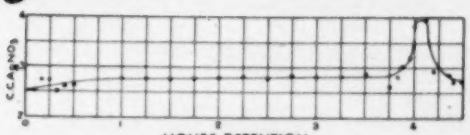
use it on wet or dry rusted steel, on wood, on concrete, on previously painted surfaces.

U. S. STONEWARE

Akron 9, Ohio

WRITE RIGHT NOW FOR DETAILS!

SPIRAFLO SETTLING TANKS PRODUCE *Excellent Results*



This salt detention curve was obtained from a 39 ft. dia. by 9 ft. S.W.D. primary Spiraflo, when the theoretical detention in the tank amounted to 5.3 hrs. Depth of Spiraflo skirt 7'-4".

OTHER ADVANTAGES OF SPIRAFLO CLARIFIERS

1. All Spiraflos have the skimming feature; hence a final clarifier can be used temporarily as a primary.
2. The actual detention of the Spiraflow approaches more nearly the design detention time than do other types of clarifiers.
3. The cost of the tank for the Spiraflo is low since all of its walls are vertical without overhanging weir troughs which require additional forming.

LAKESIDE ENGINEERING CORP.

222 WEST ADAMS STREET CHICAGO 3, ILLINOIS

- Pump Controls
- Duplex Pump Alternators
- High and Low Level Cutoffs
- High and Low Level Alarms
- Multi-level Signals
- Liquid Metering
- Special Controls and Panels

Write For 32 Page Catalog

•

Some Territories Still Open

CHARLES F. WARRICK CO.

1968 W. Eleven Mile Rd.
Berkley, Mich.

Warrick

FLOATLESS
LIQUID LEVEL CONTROLS
ELECTRODE TYPE

NO MORE VALVE TROUBLE FROM SAND AND SILT!

Here's the valve that's proving itself the ideal one for such water-works applications as sand-filter bed intakes, back-wash service, meter testing.

DeZURIK EASY-OPERATING PLUG VALVES beat the problem of sand and silt through their exclusive rubber-faced plugs—plugs that provide a dead-tight, cushioned closure even with solids on the seat. There's no seat-scoring, no plug distortion, no lubrication . . . and no leakage!

There's a DeZurik Valve for every job; write for complete catalog.

DeZURIK SHOWER CO.

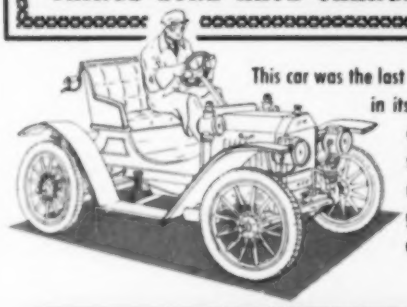
SARTELL, MINNESOTA

Briefly the process involves the grinding of the garbage or any other organic wastes. This material is transferred to the inner silo, in the same manner that ensilage would be. The juices from the stored garbage drain through the perforated inner shell and the six breather and inoculation pipes into a wet well beneath. The liquor which has been inoculated with an aerobic culture is constantly recirculated through the perforated pipes within the composting garbage. In 28 days the conversion of smelly garbage to black earthy humified and odor free compost is complete. Then the silo is opened and the friable compost withdrawn for use on land as is, or for fortification with phosphates and use or sold as a balanced organic fertilizer. The liquid from the drain well is used to inoculate another silo being filled and the balance is disposed of on land or sold as a liquid organic fertilizer to florists and truck gardeners.

The process, maintained on the aerobic side, is said to be free of any objectionable odors, safe and sanitary, while also yielding a profit claimed to pay for the installation within three years.

For more detailed information request literature from The American Composter Co., 4016 So. Cedar St., Lansing (10), Mich. Or fill out an inquiry coupon with the above key number and mail to this magazine.

THINGS SURE HAVE CHANGED SINCE THEN



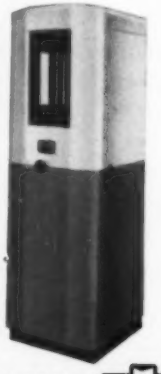
This car was the last word in transportation . . . in its day. But would you buy one for use on today's super highways? Certainly not. Then why buy chlorine gas feeders of yesterday's design?

CHLORINE GAS FEEDERS HAVE CHANGED, TOO!

Builders Chlorinizers are modern as the new car in the dealer's showroom. They incorporate many unique features not practical or possible a few years back.

For instance, Builders Chlorinizers employ a special tantalum diaphragm chlorine control valve. Only with the perfection of a process for producing pure, ductile tantalum has it been possible to develop a metal diaphragm chlorine control valve of complete durability.

Other up-to-the-minute features of Builders Chlorinizers include: (1) odor-free operation, (2) true flow meter for indicating actual chlorine gas flow, (3) simple, low-maintenance design, (4) no packed valves in chlorine flow line, (5) super-safe operation insured by powerful, spring-loaded control valve for instant shut-off should any condition interfere with safe operation.



Yes, design makes the difference! It will pay you to look into the chlorine gas feeders that are modern as the new car in your garage, the television set in your living room, the dishwasher in your kitchen.

Write for complete details and Bulletins. Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Ave., Providence 1, Rhode Island.

BUILDERS PROVIDENCE Instruments

Beckman Adds 14th Building

Beckman Instruments, Inc., South Pasadena, Calif., has announced the addition of another building to the thirteen it already occupies in the South Pasadena and Pasadena areas in California.

The newest plant, a modern glass and fieldstone unit similar to others in the Beckman group, will house the Personnel Departments as well as a new Special Products Division in which engineering and production facilities are centralized for the development of new types of instruments to meet special needs.

The building surrounds an attractive garden patio on which the inner offices face and, in addition to the offices, includes a laboratory and manufacturing area.

Otto Reynolds Celebrating 25th Year With Leadite

Otto Reynolds, of Kansas City, Mo., during the recent A.W.W.A. Convention in Kansas City, was proudly celebrating the fact that this is his silver anniversary year with the Leadite Co. He has, for the entire 25 years, represented Leadite as central-west representative.

Immediately prior to his connection with the Leadite Co. in 1927 he was department engineer in the Houston, Texas Water Department under G. L. Fugate, then city engineer. Prior thereto, Reynolds was construction engineer for the Elec-

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

tric Bond and Share Co. He served in World War I as a chief instructor with the U. S. Air Force at Kelly Field, Texas, and later was flying teacher at Love Field, Dallas. After the war he was, for a period, resident engineer on water and sewage projects for the Elrod Engineering Co. of Texas.

Sounds as if Otto might have been a son of the southwest, but not so. He was born in Wilmington, N.C., moved to Herkimer, N.Y., at a young age, graduated from Syracuse University and thereafter studied Military Aeronautics at M.I.T. in 1917.

Reynolds, a registered engineer in Missouri, is a member of A.S.C.E., N.S.P.E., Mo. S.P.E., and the A.W.W.A. He served with the old Mo. Valley Section of A.W.W.A. as its effective membership committee chairman, and in 1945 was voted the Geo. W. Fuller Award in recognition thereof.

Congratulations, Otto, on your 25th year of selling. May your many friends continue to multiply with the years ahead.

Chemical Solution Feed Pump

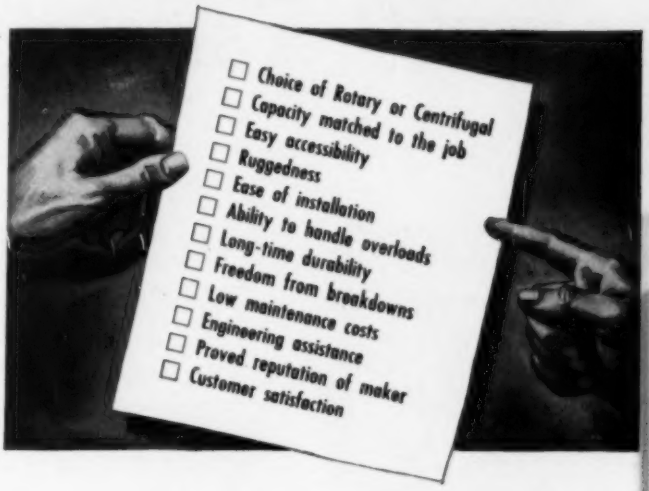
705

Precision Machine Co., Somerville, Mass., has developed a positive displacement, diaphragm type pump for accurately pumping small amounts of chemical solutions.

A shaded pole electric motor and a reduction gear train contained within an aluminum alloy casting, and immersed in oil, reciprocate a diaphragm by means of an eccentric cam. All parts that come into contact with the pumped solution are chemically resistant plastic or rubber.

The Model S can feed up to 60 gallons of sodium or calcium hypochlorite solution a day and adjustments can be made while unit is in operation to vary feed anywhere from 5 to 60 gallons per day. The pump will also treat up to one million gallons of water in a day at 1 p.p.m. dosage when pumping a 4% sodium fluoride solution.

BEFORE BUYING *any* BLOWER COMPARE THESE ESSENTIALS


☐ Choice of Rotary or Centrifugal
☐ Capacity matched to the job
☐ Easy accessibility
☐ Ruggedness
☐ Ease of installation
☐ Ability to handle overloads
☐ Long-time durability
☐ Freedom from breakdowns
☐ Low maintenance costs
☐ Engineering assistance
☐ Proved reputation of maker
☐ Customer satisfaction

When operation of sewage treatment plants depends so vitally on adequate handling of gas or air, you can't afford to take chances on the performance of your blowers or exhausters. It's better to be safe than sorry.

So, for new installations or replacements, we suggest that you evaluate the equipment by the above standards of comparison. This will help determine the unit that will be most effective, economical and reliable for your specific applications.

Be sure to include the R-C *dual-ability* line of both Centrifugal and Rotary Positive types. Remember, that only we offer you this *dual choice* —with unbiased recommendations from almost a century of experience. With capacities from 10 cfm to 100,000 cfm or higher at moderate pressures, R-C equipment has a long record of outstanding performance in sewage treatment applications.

We'll gladly send detailed information for comparison—or supply engineering help if we can be of service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
521 Mount Avenue, Connersville, Indiana

Motor-driven, 16,000 cfm Centrifugal Blower in large metropolitan sewage treatment plant. Three high-capacity R-C Rotary Blowers are also included in this installation.

ROOTS-CONNERSVILLE BLOWER
A DIVISION OF DRESSER INDUSTRIES, INC.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Just a hammer and a knife . . . and you're in business. Nail flexible, polyvinyl Labyrinth Waterstop to the wall—*inside* your form—and forget about water seepage between concrete pours. Here's a real time, trouble and money saver.

- *No Special Forms needed since no fins protrude into new pour.*
- *No Metal Fins to tear or bend out of place.*
- *No Welding or Vulcanizing expense. A hot knife joins sections in two or three minutes.*
- *No Maintenance. Polyvinyl lasts indefinitely, resists temperature changes and chemical action of concrete.*
- *For further information—clip coupon!*

Labyrinth Waterstop
The first really satisfactory water seal—eliminates seepage problems, simplifies form work.

WATER SEALS, INC.
400 W. Madison Street
Chicago 6, Illinois

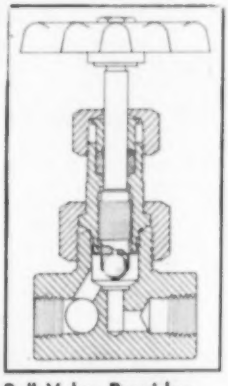
WATER SEALS, INC.
400 W. Madison Street
Chicago 6, Illinois
Please send further information on LABYRINTH WATERSTOPS

Name_____
Company_____
Address_____
City_____ Zone_____ State_____

Ruhling Washington Rep. for Concrete Pipe Assn.

American Concrete Pipe Association has announced the appointment of John A. Ruhling as Washington Representative.

Ruhling received his engineering training at Armour Institute of Technology, and has held important positions with the Sanitary District of Chicago, the Bridge Division of the Chicago Board of Public Works, the Atlas Portland Cement Company and the Portland Cement Association. A Navy veteran of World War I, he was administrative assistant to the general manager of the Century of Progress Exposition, later becoming Field Engineer for the Portland Cement Assn. and later Manager of Personnel Training for that association.



Ball Valve Provides Assured Tight Seating

706

Foxboro Company, Foxboro, Mass., has announced a new ¼ inch Ball Valve of unique construction, recommended for working pressure up to 3000 psi.

Tight, positive shutoff is provided by a stainless steel ball which closes into a machined, conical seat. The ball, retained at the end of the stem, is free-rolling so that every closing brings a new surface into contact with the valve seat. Alignment of ball to seat is accurately piloted by a forged steel, union-type bonnet, fitting tightly

(*Continued on page* 101A)

REPLACE troublesome **VALVES** *With . . .*

EDDY
MECHANICAL JOINT GATE VALVES

Old and troublesome valves . . . or too few valves in a distribution system . . . can be responsible for dangerous and costly slow-down or shut-down of water supply for every day use or, more serious, when badly needed in event of an emergency. Now is the time to make replacements and to install new valves where conditions show the need for so doing. The Eddy Valve, bronze mounted throughout, with mechanical joint connections (only a ratchet wrench needed) is best for easy installation . . . for easy operation . . . for long life trouble-free service.

Write today for prices and delivery date for valves needed to modernize your water distribution system.

EDDY
VALVE COMPANY
A Subsidiary of James B. Clow & Sons
WATERFORD, NEW YORK

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

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WATER & SEWAGE WORKS READER SERVICE

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Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(Continued from page 100A)

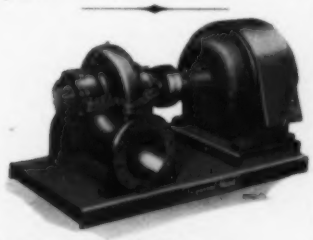
to the body and assuring a correct valve closure.

The long-stroke stem and the packing gland are made of stainless steel for durability and resistance to corrosion. The packing is a preformed, graphited asbestos with a plastic binder and can easily be replaced without shutting off the line pressure or interrupting the process. Straight-through and angle types are available with two and four connections.

Brown Appointed to Hardinge's Central District Office

Hardinge Company, Inc., York, Pa., has announced the appointment of Clarence Blair Brown, Jr., to the Central District office in Chicago to fill the vacancy created by the transfer of Clement W. Ankeny to the Phoenix, Arizona, territory.

Mr. Brown came from the Navy directly to the Hardinge organization as an engineer and, until his appointment to the Central District office, had been engaged in field service, estimating, development, design and sales engineering work at company headquarters in York, Pa.



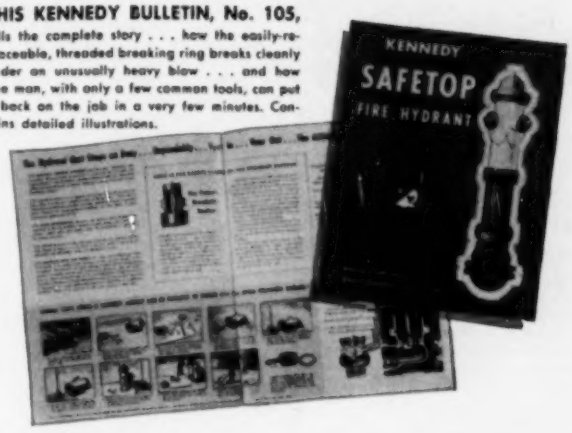
Improved Single-Stage, Double-Suction Pumps

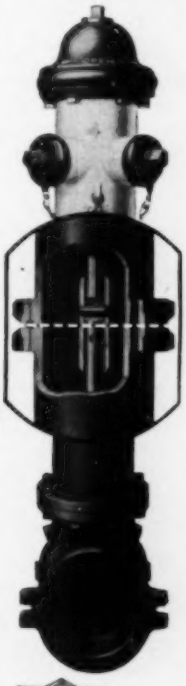
707

Ingersoll-Rand, New York, N.Y., has announced further advanced design improvements in its existing line of small, single-stage, double-suction pumps. These pumps, known as the Class DMV-DHV, are the first to incorporate double mechanical shaft seals with sealed, pre-lubricated ball bearings. The result is a compact, totally enclosed pumping unit that requires minimum attention and maintenance and reduced floor space requirements.

See how one man can repair a KENNEDY SAFETOP hydrant in only 11 minutes . . .

THIS KENNEDY BULLETIN, No. 105, tells the complete story . . . how the easily-replaceable, threaded breaking ring breaks cleanly under an unusually heavy blow . . . and how one man, with only a few common tools, can put it back on the job in a very few minutes. Contains detailed illustrations.





KENNEDY SAFETOP FIRE HYDRANTS are the toughest to knock out . . . yet, the easiest, the quickest, and the most economical to repair, even after being smashed or broken by a car or truck. This means a substantial saving for your community . . . in labor and maintenance costs. It also means better, safer fire protection. And it can make *your* job easier, too!

GET ALL THE FACTS! You'll want this informative KENNEDY hydrant booklet in your files. It gives valuable information on the design and maintenance of *modern* KENNEDY Fire Hydrants.

WRITE TODAY FOR KENNEDY SAFETOP BULLETIN 105

THE COMPLETE KENNEDY LINE includes a wide range of A.W.W.A. valves, as well as fire hydrants. Valves are made with iron 50% stronger than ordinary cast-iron . . . in a wide variety of types. Sizes from 2" to 60". For extra quality and dependability, standardize on KENNEDY.

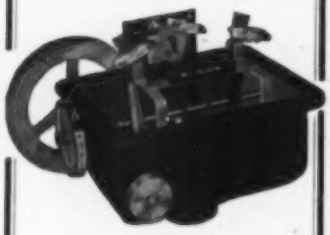
WRITE FOR BULLETIN 106

Est. 1877

THE **KENNEDY**
VALVE MFG. CO. • ELMIRA, N.Y.

VALVES • PIPE FITTINGS • FIRE HYDRANTS

ROTO-TROL



RF-2

WITH ALTO-TROL This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF COMPANY

733 HAMPDEN AVE., ST. PAUL 4, MINN.

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation

HIGHLY EFFICIENT

IMMEDIATE SHIPMENT

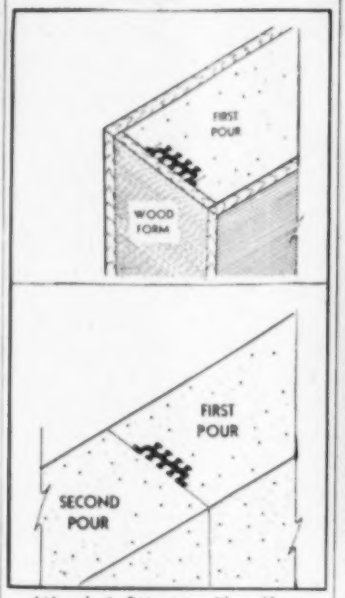
Catalog No. 25G On Request

JOSEPH G. POLLARD CO., INC.

Pipe Line Equipment

New Hyde Park New York

Built in 3, 4, 5, and 6 inch sizes, the DMV (for medium heads) and the DHV (for high heads) are designed for general hydraulic services at temperatures up to 200°F, and capacities to 2100 gpm and pressures to 150 psi.



(Above) A first pour with a Harza Labyrinth Waterstop in place inside the simple wood form. (Below) First and second pours after forms have been removed, showing how the Labyrinth Waterstop joins the two and seals the joint against leaks.

Labyrinth Waterstop Prevents Water Seepage Through Joints in Concrete

708

Water Seals, Inc., Chicago, Ill., has developed the Labyrinth Waterstop that prevents water from leaking through joints of concrete "pours."

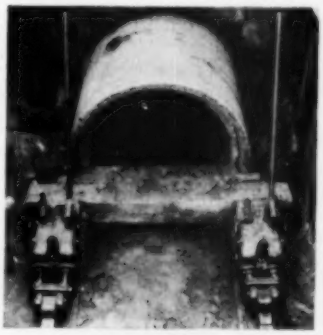
The company states that no expensive carpentry work on the forms is necessary when the Labyrinth Waterstops are used as they fit entirely inside the form for the first pour. They are quickly nailed in place on the form.

Normal vibration of the concrete mass is more than enough to fill the grooves of the Labyrinth even when coarse aggregate is used. The Labyrinth is made of a flexible, easy to handle polyvinyl plastic that resists both temperature changes and the chemical action of concrete.

Labyrinth Waterstop comes in 100-foot lengths, in 3 widths (3¼, 4¼, and 5¼ inches), that can be cut in the field with anything from a cir-

SAVE HOURS, CUT COSTS ON YOUR PIPING JOBS

PUSH PIPE UNDER STREETS, TRACKS, walks, floors and other obstacles with a GREENLEE Hydraulic Pipe Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes—model shown above for pushing ¾ to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump also available for extra ease and speed of operation.



GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 2247 Columbia Avenue, Rockford, Illinois, U.S.A.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

cular saw to a pocket knife, and separate sections can be joined quickly together either with a hot knife or an ordinary torch.

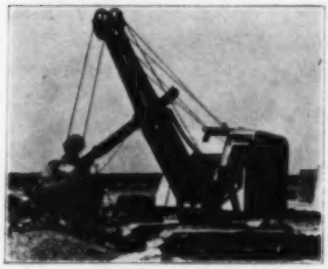
Two Rockwell Men Made V.-Ps.

Rockwell Manufacturing Company, Pittsburgh, Pa., has announced the election of L. A. Dixon and Jas. E. Ashman as Executive Vice Presidents.

Mr. Dixon was associated with the Wisconsin Axle Company and started at the Pittsburgh Equitable Meter Company, now a division of Rockwell, in 1926 as Assistant to the President.

Later, he was President of the Pittsburgh-DuBois Company, and when that company was acquired by Rockwell he continued to serve in the same capacity until he relinquished that position to accept the vice-presidency of the Company's meter and valve divisions.

Mr. Ashman joined Rockwell in January 1947 as Controller and later held both this position and that of Vice President. He has had long experience in selling, having served in an executive sales capacity for several firms. He was also director of procedures for the United States Steel Corporation in Pittsburgh.



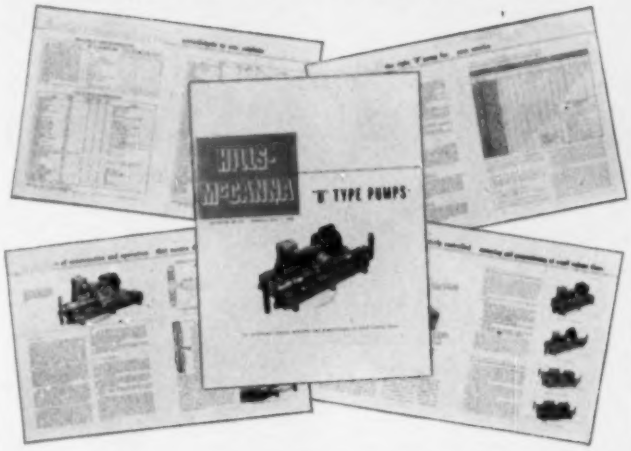
Excavator and Truck Crane

709

Gar Wood Industries, Wayne, Michigan, has announced the new Gar Wood 75 standard and heavy duty ¾ yard excavator and 20-ton truck crane, featuring power actuated drum clutches, direct right angle drive, optional hydraulic coupling and the new Foundation Borer attachment.

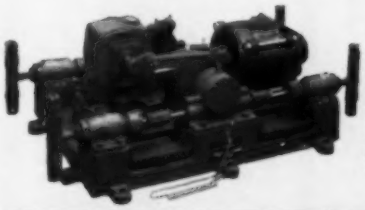
Operated by direct, extra-sensitive manual controls, the Gar Wood uses the engine's power to engage the heavy duty clutches. Gar Wood's exclusive right angle drive, transmitting power through a universal coupling for lasting alignment, reduces fuel consumption by insuring the smoothest possible flow of power and elim-

Here's a handy guide to the selection of metering and proportioning pumps



In this new catalog and pump selection manual for Hills-McCanna "U" Type Metering and Proportioning Pumps is all the information, including prices, for the selection of exactly the right pump for handling over 300 substances. Clearly and concisely, this helpful booklet gives all the necessary information and specific recommendations to cover the vast majority of needs that can be filled with a Hills-McCanna "U" Type Pump.

If your operations involve the metering or proportioning of small volume flows, you will find this catalog a useful addition to your files. We will be pleased to send you a copy on request. HILLS-McCANNA COMPANY, 2357 W. Nelson St., Chicago 18, Illinois.



Hills-McCanna "U" Type Pumps are reciprocating, variable stroke, mechanical drive units with maximum capacities ranging from 0.10 to 24 gph. per feed. One, two, three and four feed assemblies are available. Operating pressures up to 5,000 psi. A four feed unit is shown at the left.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of: Saunders Patent Diaphragm Valves Force Feed Lubricators • Magnesium Alloy Sand Castings

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

inates the maintenance, noise, slack and back-lash problems of chain drives.

Completely convertible in the field to shovel, crane, dragline, clamshell, trench hoe or pile driver, the Car Wood 75 is also available as a completely convertible, factory installed Foundation Borer.

Self-Priming Turbine Vane Pumps

710

Peerless Pump Division, Food Machinery and Chemical Corp., Los Angeles, Calif., has introduced a complete line of self-priming and standard design turbine vane type pumps.

Standard construction materials for handling clear water is with cast iron case, bronze impeller and liners, stainless steel shaft and a standard mechanical shaft seal. Cover liner, impeller and inner liner are all replaceable.

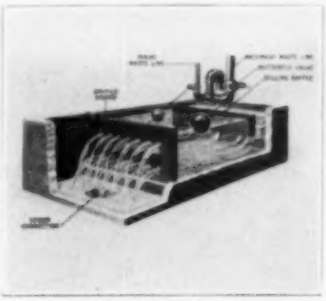
Capacity range at 3500 rpm is up to 58 gpm; at 1750 rpm, up to 56 gpm. Head range at 3500 rpm is up to 800 feet; at 1750 rpm, up to 300 feet. Motor sizes up to 20 hp are available at 3450 rpm and up to 7½ hp at 1750 rpm.

Regional Manager for Middle East Named by Worthington Corporation

Worthington Corporation, Harrison, N.J., has announced the appointment of J. R. Hutchison as regional manager for the Middle East. Mr. Hutchison will manage Worthington's activities in Cyprus, Egypt, Greece, Iran, Iraq, Israel, Lebanon, Syria, Trans-Jordon and Turkey.

An 18-year Worthington veteran, Hutchison has served successively as application sales, and then field engineer in Worthington's pump, priorities, compressor and export departments. More recently he has served as a compressor specialist in the export department.

Mr. Hutchison will be headquartered at Emlak Cadessi 20/3, Istanbul, Turkey.



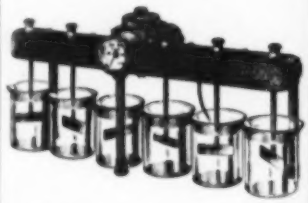
Anti-Back-Siphonage Wash and Rinse Controller

711

Permutit Company, New York, N.Y., has developed a new Anti-Back-Siphonage Wash and Rinse Controller that has been designed to prevent excessive rates of flow during backwashing or rinsing, and to eliminate the possibility of back-siphonage of waste water. The unit is said to conform with state and local laws against back-siphonage.

The arrangement is standard on all Permutit's sodium zeolite softeners

P & B Multiple Stirrer



When several samples are mixed simultaneously under identical conditions the optimum concentration of flocculent may be quickly selected and translated to plant quantities . . . The mixes takes 1,000 ml. beakers. Speeds from 10 to 100 r.p.m. are standard.

Write: **Cat. No. 77-700**

Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

LEADITE

The Pioneer Self Caulking Material for C.I. Pipe

MORE THAN 50 YEARS PROVE IT!

• Tested and used by engineers, water works men and contractors for more than 50 years. LEADITE has proved its dependability under most every condition of water main construction . . . proved that it makes a good tight lasting joint that improves with age.

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

The practical, economical answer to your underdrain problems

LEOPOLD

Glazed Tile

FILTER BOTTOMS

No corrosion or tuberculation • Practically non-absorbent • Equal filtration, distribution • Low loss of head • Long life • Proved superiority.

Write for details!

F. B. Leopold Co., Inc.

2413 W. Carson Street

Pittsburgh 4, Pa.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

that are 54 inches in diameter or larger. It can be provided for hydrogen zeolite, anion exchange, and pressure type filter equipment whenever local requirements call for it.

Water flows at a constant rate through orifices of fixed size, under a constant head maintained by the utilization of a float-operated butterfly valve. Thus, greater than normal pressure does not affect the rate of flow.

The waste water discharge line terminates at a minimum distance of 6 inches above the rim of the sump. This provides a positive air gap in accordance with the requirements of the American Standards Association. It prevents backflow of water from the sump in the event that negative pressure should occur in the water supply system during the backwashing or rinsing operation. A stilling baffle prevents turbulance in the constant level water chamber, thus avoiding irregular action in the float.

A. J. Kerr Resigns from Rockwell

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced that A. J. Kerr, Vice President, of Meter and Valve Sales has resigned to form his own company to develop and sell products to the oil and gas industry.

Mr. Kerr is a mechanical engineering graduate of Carnegie Institute of Technology and was formerly a director of the American Society of Mechanical Engineers. He has been associated with Rockwell for 25 years and was district sales manager of the Tulsa office until 1944 when he came to Pittsburgh as general sales manager.

Multi-Stage Centrifugal Pumps by I-R.

712

Ingersoll-Rand Company, New York, N.Y., has redesigned their line of horizontal, multi-stage centrifugal pumps for medium-pressure applications, incorporating modern hydraulics that give higher efficiency and better operation.

This class CNTA pump features a horizontally-split, smooth-bore cylindrical casing which contains the Unit-

costly corrosion checked!

Saran Rubber at Work

These large cation and anion exchangers regenerate the ion resin in a 10% concentration of hydrochloric acid. Ordinary linings pulled out and cracked at the flanges. There has been no difficulty since saran rubber was installed 33 months ago.

with SARAN RUBBER tank Lining

Industries handling, storing or transporting corrosives can lower operating costs and increase the life expectancy of costly equipment by installing saran rubber tank lining. The high degree of both chemical and abrasive resistance makes saran rubber an outstanding lining where resistance to grease, many solvents, acids and other chemicals is required.

Saran rubber can be applied easily, effectively and economically by experienced tank lining applicators located strategically throughout the country. Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office.

for tank cars
storage tanks • tank trailers
processing tanks
production tanks

RELATED PRODUCTS

Saran rubber molded parts—stoppers, diaphragms, various-sized moldings for valves, instruments, etc.

Saran lined steel pipe—corrosion-resistant pipe that gives long-term operation with minimum maintenance.

Write to the Distributor:

SARAN LINED PIPE COMPANY

2415 BURDETTE AVENUE • FERNDALE, MICHIGAN

Offices in: New York • Boston • Pittsburgh • Tulsa • Philadelphia Chicago • Portland • Indianapolis • San Francisco • Houston • Denver Los Angeles • Seattle • Cleveland • Charleston, S.C. • Toronto • Montreal

clip and send today!

Saran Lined Pipe Company
2415 Burdette Avenue, Ferndale, Michigan

Please send me your catalog on Saran Rubber Tank Lining and Saran Rubber Molding Stocks.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

WW-E

SARAN RUBBER
DOW
product

Type rotor assembly. This assembly is composed of the shaft, impellers, and channel rings, which contain the multiple-volute fluid passages. The engine rotor assembly is quickly and easily removed from, and installed in, the smooth-bore casing, since there are no mating ring fits or delicate alignment problems.

Labline, Inc. Organized Under Newman Management

Laboratory Industries, Inc., Chicago, Ill., and Mr. Alexander I. Newman, formerly executive vice president of Precision Scientific Company, have announced the formation of Labline, Inc. for the manufacture of laboratory apparatus, instruments, and equipment.

In his capacity as president of the new corporation, Mr. Newman, in addition to his administrative duties, will devote special attention to new laboratory instrumentation. Arrangements are now being completed for enlarged manufacturing, research and development facilities.

The company's expanding line of products sold under the names "Alumaloy" and "Labline" include laboratory clamps, apparatus, baths, ovens, and laboratory furniture.

Midget Laboratory Stirrer

713

Laboratory Industries, Inc., Chicago, Ill., has developed a multi-speed stirrer with 3 predetermined speeds best suited for general laboratory stirring. Speeds of 300; 600; and 900 R.P.M. are pre-selected by a convenient knob.

The motor of the stirrer is series wound with a horsepower of 1/16 and pulls 65 watts. A specially designed mounting bracket permits the stirrer to be mounted in any position. In the normal position the center of gravity is below the support rod which prevents accidental turnovers and breakage of beakers. The stirrer can be mounted by sliding on a rod or it can be hooked on and removed without disturbing any set-up.

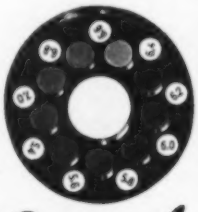
The stirrer comes complete with 3 jaw chucks, 2 position mounting bracket, 8 ft. rubber covered cord and plug and 8 inch aluminum support rod.

Wheeler-Economy Breaks Ground for New Plant Addition

C. H. Wheeler Manufacturing Co., Philadelphia, Pa., has broken ground for a $600,000 addition to their plant. The new building will be equipped with 30 ton cranes and will be 300 feet long.

A considerable number of new machine tools are being purchased so as to make the Philadelphia plant capable of handling an increased volume of condenser, pump, and naval deck machinery production.

A new centrifugal pump test laboratory is being provided with a 400,000 gallon pit with Venturis, weirs and dynamometers, for testing pumps up to 110,000 gallons per minute.



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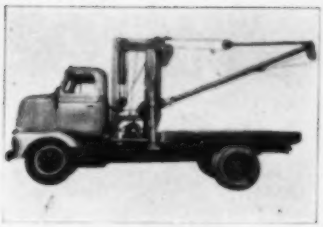


Low-Cost Hydraulic Truck Crane

714

Pitman Manufacturing Co., Kansas City, Missouri, has announced the production of a new model of the Pitman Hydra-Lift. The Hydra-Lift, a recently developed crane with hydraulically powered boom, can be mounted on the frame of any truck, 1½ tons or larger.

According to the manufacturer, the new model features a variety of improvements over the original model, introduced late in 1950. Hydra-Lift requires but 40 inches behind the cab of a truck, has a load-line capacity of 6,400 pounds and a swinging boom which telescopes from 12 to 17 to 22 feet.

The two chief improvements in the new model are (1) a big increase in the unit's safety margin and (2) the fact that it now is shipped almost completely pre-assembled, cutting the time and cost of installation.

Conoflow Represented in Pacific Northwest

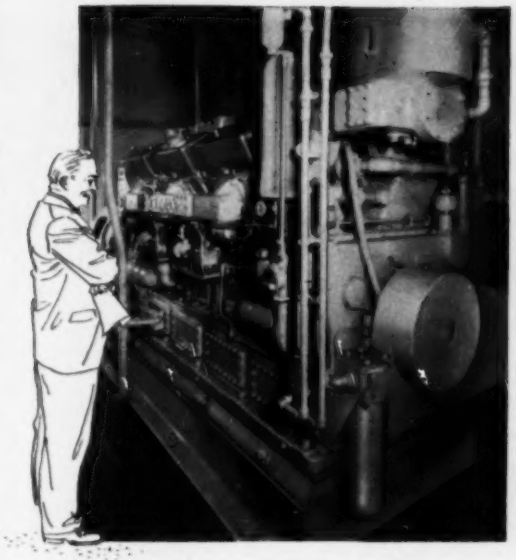
Conoflow Corporation, Philadelphia, Pa., has announced the appointment of Instrument Sales Corporation as their representatives in the Pacific Northwest. Located at 2137 Second Avenue in Seattle, Instrument Sales will service Washington, Oregon, and northwest Idaho with Conoflow pneumatic control equipment.

The Principals of the organization are Ray H. Branom, Victor Miller, and Eugene Leeland. Incorporated in 1947, Instrument Sales has been in business since 1938, specializing in installation and engineering service for their equipment in both the industrial and marine fields.

New Pneumatic Scale

715

Fluid Controls Company, Inc., Philadelphia, Pa., has announced the new F-C "air scale" Weight Transmitter. The transmitter is a completely pneumatic scale for either batch weighing or continuous process control.



Climax V-12, 250 KVA, 440 Volt Standby Generator Set

A climax BLUE STREAK ENGINE PROTECTS BALTIMORE

The new sewage lift station in Baltimore, Md.

In the new Brooklyn sewage lift station a Climax gasoline engine driven generator stands ready to automatically and immediately take over the entire load when normal power fails.

As a result of its dependable performance three similar units are being installed in the Dundalk pumping station which is under construction.

Climax engines are custom built to specifications to assure maximum dependability and continuous operation. Sizes for standby service– 75 to 600 H.P. Low speed sewage gas engines are built in sizes– 50 to 250 H.P.

For complete information write to Climax Engine & Pump Mfg., Co., 208 S. La Salle Street, Chicago 4, Illinois

climax

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Factory and General Office: Clinton, Iowa
Regional Offices: Chicago, Ill., Dallas, Texas

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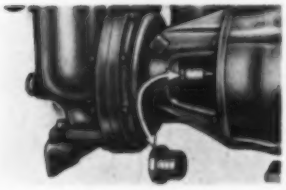
Troubled with Leaky Stuffing Boxes on Your Pumps?



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MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MANUFACTURING CO.
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The new device accurately converts a variable force or weight into an easily measured pneumatic signal. Operating on the force-balance principle, the weight transmitter will indicate, record, or control weight or force through standard instruments in the manner commonly applied to temperature, flow, pressure, and level problems. Uses range from simple weighing operations to elaborate batch or continuous flow control of either solids or liquids.

In operation the scale "balances out" any tare, thus allowing net weight to be indicated directly on standard panel board instruments. Accuracy of the net weight output of the air scale is limited only by the characteristics of the indicating instruments used with it.

Conoflow Appoints Tennessee Representatives

Conoflow Corporation, Philadelphia, Pa., has announced the appointment of the Equipment Sales Corporation as representatives serving eastern and central Tennessee as well as southwestern Virginia with Conoflow pneumatic control equipment.

Manufacturers' representatives in the Tennessee area for the past six years, Equipment Sales is headed by S. E. Abernathy and R. Glynn Thomas. Well-qualified in the instrument field, Mr. Abernathy was formerly chief instrument engineer for a large southern process industry, while Mr. Thomas was engaged in sales and service work for a nationally-known instrument manufacturer.

Combination Drill Rig

716

Mobile Drilling, Inc., Indianapolis, Ind., has announced a new combination drill offering all three methods: rotary, auger, and percussion drilling on the same rig.

The new Mobile Drill has a hydraulic feed of approximately 8,000 lbs. pressure. The hydraulic feed cylinder is located directly over the rotary turn table.

The carriage of the drill is of tubular construction. The drill mast, also of tubular construction, nests in the tube members of the drill carriage for cross-country travel with a maximum over-all height of 10 feet.

The Mobile Drill can be furnished with an auxiliary cat head, sand reel, and special high pressure water pump. The B-36 maximum depth for auger drilling without water is approximately 150 feet; depth for rotary drilling with water is in excess of 300 feet.

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Northrop

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If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

The light weight of the unit, which can be mounted on a Willy's Jeep or any truck with a power take-off makes it a unit that may be moved with ease over very rough terrain.

Dr. Marshall Appointed Director of Link-Belt Research Laboratory

Link-Belt Company, Chicago, Ill., has announced the appointment of Dr. Lauriston C. Marshall as Director of the company's new Physical Testing and Research Laboratory at Indianapolis.

As Director of the new Laboratory, Dr. Marshall will be responsible for an extensive program of original research, as well as for continuing investigation into ways and means of improving production methods and the quality of conveyor and power transmission products developed by Link-Belt's 16 manufacturing plants in the United States, Canada and south Africa.

New Scale Remover

717

Apex Engineering Co., Chicago, Ill., has developed "Rydlyme" solvent for safely and quickly removing scale forming in pipes, evaporators, condensers, heat exchangers, water heaters and coils.

The fact that Rydlyme is completely safe is illustrated by a demonstration the company uses to show its non-corrosive, yet fast-dissolving qualities. A particle of scale is held in the hand by a company representative and a small amount of Rydlyme is poured on the scale. In a few moments the scale disappears into a harmless gaseous state. Water is completely safe for drinking purposes after pipes are cleaned with Rydlyme.

Rivers Appointed Director Engineering Service for Hall Laboratories

Hall Laboratories, Inc., Pittsburgh, Pa., has announced the promotion of H. M. Rivers, Assistant Director of Engineering Service, to Director of Engineering Service.

He succeeds J. N. Welsh, who as Associate Director of Hall Laboratories, Inc., recently assumed new business administration duties in this firm.

Mr. Rivers joined Hall Laboratories in 1936 as a service engineer, and the following year was assigned to the Philadelphia office as district service engineer. He returned to the headquarters engineering staff at

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Full Circle CLAMP COUPLINGS

Widths
5" to 30"
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★ For PERMANENTLY repairing broken or cracked pipe

By utilizing the flexibility, durability and strength of copper or stainless steel, the Smith-Blair Full Circle Clamp Coupling has proved itself to be a revolutionary repair unit. It is fast becoming the standard method of repair for the water works throughout the United States and Canada. It is a permanent repair unit for any type of pipe.

- Lowers Initial Cost
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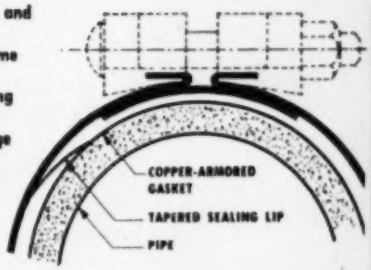
- Gives higher percentage of complete shut-offs on the first try — under pressure.



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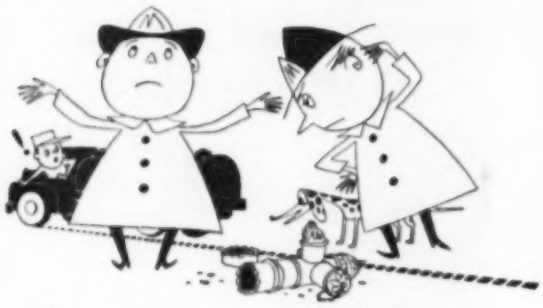

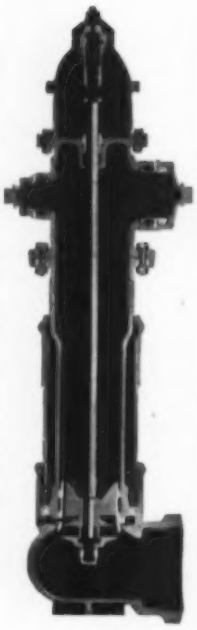

The main valve opens against water pressure and closes with it. This is foolproof protection against flooding when hydrants are broken in traffic accidents.

MATHEWS
HYDRANTS

Made by R. D. Wood Company Public Ledger Building, Independence Square, Philadelphia 5, Pa. Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves.

Mathews Modernized Hydrants . . . Tops in Convenience and Dependability Compression-type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in barrel • A modern barrel makes an old Mathews good as new • Available with mechanical joint pipe connections

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Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

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822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

Hall's home office in Pittsburgh in 1949, and was appointed Assistant Director of Engineering Service in 1951.

Variable-Flow Pinchcock

718

Fisher Scientific Co., Pittsburgh, Pa., has announced the development of the first variable-flow pinchcocks.

The new Vari Flow for controlling gas and fluid flow in rubber and other flexible tubings up to ⅜" diameter is a modification of the Fisher Pinchcock, with all of the advantages of that Pinchcock. It is made of non-rusting patented Castaloy that eliminates the objectionable tube-cutting of wire-type pinchcocks; and can be attached to—and removed from—tubing without having to draw it over the end or without having to remove connections.

The Vari-Flow's innovation is a nickel-plated brass attachment by which a set screw controls the movable jaw. Thus, the operator can select the amount of flow desired through live rubber tubing for whatever purpose.

Literature & Catalogs

Vertical Induction Motors

719

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a bulletin on **Large Vertical Induction Motors.**

The bulletin explains that except for bearing arrangement, the mechanical construction of vertical solid shaft induction motors is basically the same as that of horizontal units. The vertical motors are customarily of the open, self-ventilated type.

Motor ratings in 40 C, 60 cycle from 60 hp, 200 rpm to 800 hp and larger at 1800 rpm are also covered in the bulletin.

Chemical Solution Feed Pump

720

Precision Machine Co., Somerville, Mass., has just published a bulletin on **Precision Chemical Solution Feed Pumps.**

The 2-color bulletin gives a complete description of the pump with an exploded photograph showing the pump head assembly. As stated in the bulletin, the Model S can feed up

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to 60 gallons of sodium or calcium hypochlorite solution a day and also recommends it for fluoride feeding. Maintenance and installation instructions are included along with specifications and price lists.

Rubber Seat Butterfly Valves

721

Henry Pratt Company, Chicago, Ill., has published a bulletin on **Pratt Rubber Seat Butterfly Valves.**

The 2-color, 4-page bulletin states that the Pratt Rubber Seat Butterfly Valve embodies many improvements in design, material and construction and by means of its patented seating arrangement eliminates leakage past the disc. The valve is designed for a 50 p.s.i. operating pressure level in sizes ranging from 10 through 84 inches.

Complete construction details and cut-away drawings are shown on page 2. Dimensional charts and diagrams showing the various methods of operation of the valves complete the bulletin.

Tnemec Coatings for Water and Sewage Works

722

Tnemec Company, Inc., North Kansas City, Missouri, has just published a bulletin on **Tnemec Coatings for New Construction and General Maintenance.**

The bulletin covers the complete line of Tnemec coatings including primers, industrial, weatherproof, shingle, aluminum, and special purpose. A full-color kodachrome reproduction of a test panel on the front cover gives a visual picture of how Tnemec primers kill rust on steel and prevents undercutting by rust on adjoining exposed steel.

Page 5, covering special purpose coatings, describes Tnemecol, a product that was developed for protecting steel and concrete surfaces against corrosive and disintegrating action of raw sewage. Product 454 is recommended for water tanks and reservoirs.

Complete specifications, covering 23 different applications, are included on pages 6 and 7.

"Scotch" Tape for Pipe Wrapping

723

Minnesota Mining and Manufacturing Co., St. Paul, Minn., has just published a booklet on **"Protect Buried Pipe from Corrosion with Scotch Plastic Tapes."**

Dewatering 1500' of 8' x 14' deep sewer trench at a river crossing, this 4" Jaeger pump handled 40,000 gph at average speed of only 1200 rpm (10% to 15% lower speed than other pumps), and reprimed quickly, as needed, at 1400 rpm (compared with 1800 to 2000 rpm required to prime ordinary pumps). This is typical performance, Jaeger's larger shells and impellers, double priming action and use of largest engines applicable mean high efficiency, fuel economy, long life — in 1½" to 10" pumps.

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Prestressed "GUNITE" produces a water storage tank which is bottle tight and maintenance free. They may be built either at ground level, completely underground with earth covering over the dome roof, or may be in the form of stand-pipes or elevated tanks.

Our experience in this field includes scores of tanks and silos of many types ranging up to two and one-half million gallons capacity.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin C2400. We will gladly send a copy at your request. On your letterhead, please.

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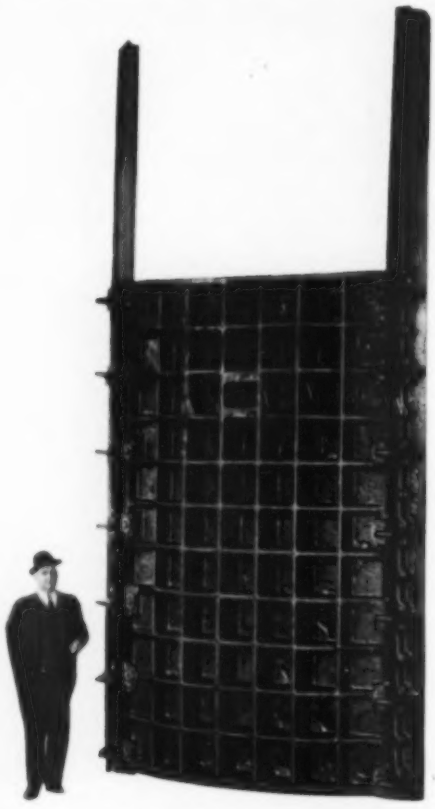

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FOR STANDS & UNDERGROUND GATES—MOTOR TRUCK MOUNTED
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The 8-page, illustrated booklet describes and illustrates both high speed machine and hand wrapping techniques for protecting natural gas and water mains, joints and leads from the corrosive effect of soil chemicals, oils and fats, stray ground currents and soil bacteria and fungi.

The booklet cites some of the problems resulting from pipe corrosion as well as actual case histories of instances where the wrapping methods described have been used. In addition, it gives tables listing the physical and electrical properties of the tapes.

Air-Operated Butterfly Valves

724

Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Philadelphia, Pa., has released a 12-page catalog covering the use of **Honeywell Air-O-Motor Diaphragm Operators with Continental Butterfly valves.** Complete specification data is given for both Standard and Heavy Duty Pattern Valves, and a wide selection of Diaphragm Operators is shown and described.

Also included in the catalog are material specifications, mounting dimensions, maximum pressure ratings and easy-to-follow selecting and ordering information.

Two New Deaerator Bulletins

725

Permutit Company, New York, N.Y., has just published two new bulletins describing the **Permutit Deaerator** and the **Permutit Vacuum Deaerator.**

The Permutit Deaerator bulletin describes it as a deaerator with internal direct contact vent condenser and discusses the advantages of this unit, which heats and deaerates water in three stages.

The Permutit Vacuum Deaerator bulletin outlines how the apparatus removes oxygen and free carbon dioxide from water so as to protect piping, steel tanks and other equipment from the harmful effects of corrosion.

Automatic Alarms

726

Automatic Control Co., St. Paul, Minn., has just released a new bulletin featuring **Autocon Multalarms.** The bulletin features multiple station panel units which provide three-way protection. One feature, as emphasized in the bulletin, of the Mult-

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alarm is an automatic reset that eliminates human error and provides continuous visual indication until the emergency condition is corrected.

The bulletin further states that Autocon Multalarms are arranged with any number of stations and with any number of alarms, and are suitable for applications where emergency conditions of liquid level, pressure, temperature, smoke, gas, etc., must be protected.

Flame-Spalled Diffuser Plates Improve Sewage Aeration

727

Linde Air Products Company, a Division of Union Carbide and Carbon Corp., New York, N.Y., has made available a booklet entitled **"Flame-Spalled Diffuser Plates Improve Sewage Aeration."** The booklet analyzes the results obtained by using oxy-acetylene flame-spalling combined with detergent washing at high pressure to clear clogged pores and permit the free flow of air.

According to the booklet, this cleaning process has more than doubled the life of diffuser plates at sewage treatment plants operated by New York City. Greater efficiency in cleaning also allows a reduction in air pressure for a considerable power saving.

Revised Zeolite Softener Bulletin

728

Cochrane Corporation, Philadelphia, Pa., has just issued a revised edition of the bulletin on **Sodium Zeolite Softeners.**

The bulletin gives a detailed explanation of zeolite water softening, including a glossary of terms used in the process, data for laying out a zeolite softening plant, the factors governing the size of equipment, the selection of zeolite materials and a detailed description of the four stages of operation of a sodium zeolite softener.

A complete description of the Cochrane Hydromatic Single Control Valve is included. This single control valve is six individual valves in one, replacing the usual "valve nest," operating easily and effectively either manually or when arranged for automatic operation.

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wanted by the City of Escanaba, Michigan, to direct operation of liquified petroleum gas plant now nearing completion and the operation of existing steam plant. Prefer applicants who have had a minimum of two years experience in utility operation. Must have degree in mechanical engineering, with degree or experience in electrical engineering desired but not required.

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Address applications, giving full particulars, to A. V. Aronson, City Manager, Escanaba, Michigan.

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"O" Rings replace conventional packing and reduce maintenance to a minimum. The lower "O" Ring is the pressure seal, the upper "O" Ring the dirt seal. The specially compounded rubber plastic "O" Rings do not deteriorate and insure a long life pressure seal.

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